# APPENDIX B

## Well Logs, Soil Boring Logs, and MIP/EC Results

100729

WESTON.

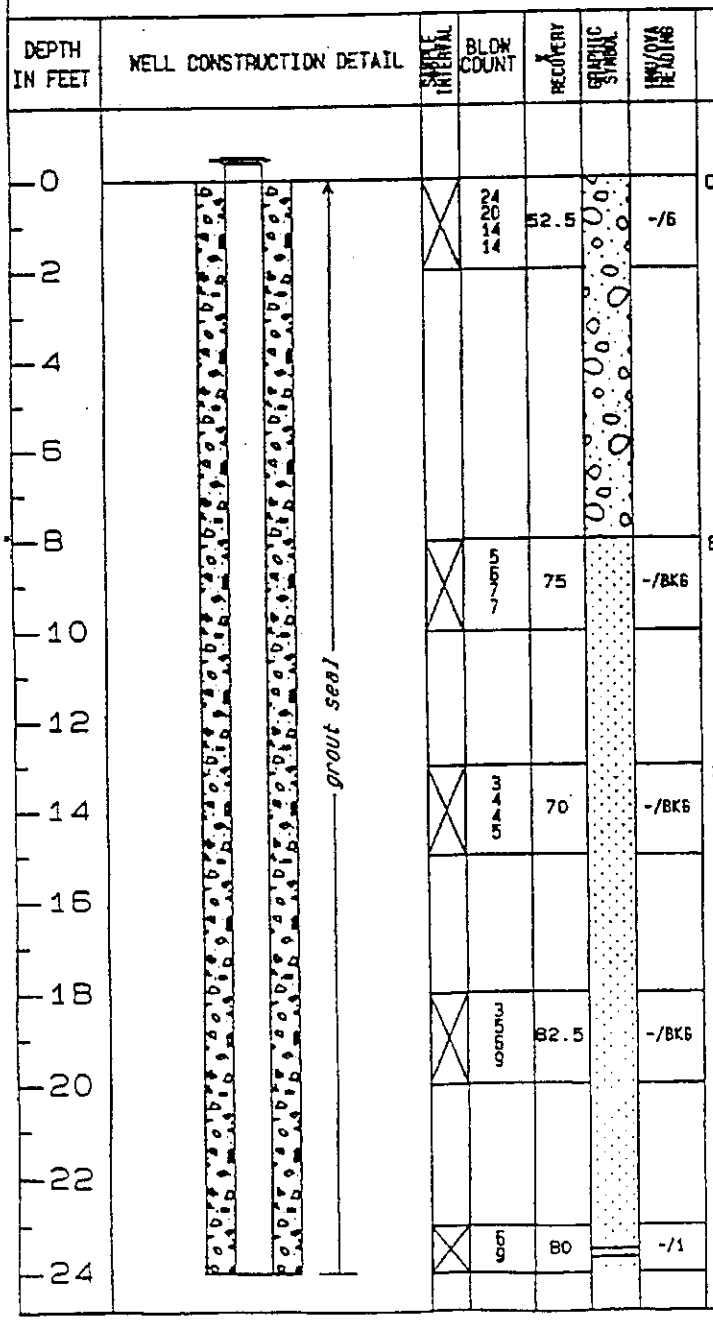
# APPENDIX D - BOREHOLE LOGS AND MONITOR WELL CONSTRUCTION DIAGRAMS

# MONITOR WELL



Project: STANDARD CHLORINE
Location: DELAWARE CITY, DE.
Geologist: D. Cairns
Drilling Contractor: JCA
Driller: Joe Jester
Drilling Method: Hollow stem auger
Diameter of Borehole: 12 inches
Diameter of Well Casing: 4 inches

Well Number: MW-01
Coordinates: 582818.90 N; 438581.98 E
Top of Casing Elevation: 49.46 feet
Groundsurface Elevation: 45.90 feet
Total Borehole Depth: 74.8 feet
Total Well Depth: 74 feet
Date Started: 2/7/90
Date Well Completed: 2/8/90




| DEPTH IN FEET | DESCRIPTION |
|---|---|
| 0-8' | Light brown to gray brown SAND and GRAVEL (FILL), loose, dry to slightly moist. |
| 8-13' | Orange-brown to tannish-white SAND, fine to coarse, trace pockets of black sand, very fine, poorly sorted, somewhat loose, dry. |
| 13-23.5' | Tannish-brown to orange brown SAND, fine to medium grained, trace coarse sand, coarse to very coarse layer from 13.7-13.75', trace to little silt, trace black sand, very fine, moderately sorted, slightly moist. |
| 23.5-23.7' | Gray clayey SILT, little sand, very fine to fine, dense, slight plastic, moist. |

# MONITOR WELL

PROJECT STANDARD CHLORINE WELL NUMBER MW-01

| DEPTH IN FEET | WELL CONSTRUCTION DETAIL | SAMPLE INTERVAL | BLOW COUNT | % RECOVERY | GRAPHIC SYMBOL | HNU/OVA READING | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| 24 | | | | | | | |
| 26 | | X | 15 12 | 80 | | -/1 | 23.7-28' Orange-brown SAND, fine to medium grained, little (10%) black sand, very fine to fine, hardpan layer (24.5-24.6'), little silt, poorly sorted, moist. |
| 28 | | X | 8 9 7 5 | 70 | | -/BKG | 28-28.3' Brown sandy SILT, black sand, very fine to fine, dense, firm, moist. |
| 30 | | | | | | | 28.3-34' Alternating layers of orange-brown and light tannish-white SAND, fine to medium grained, trace black sand, very fine to fine, somewhat loose, moderately sorted, slightly moist. |
| 32 | | | | | | | |
| 34 | | X | 8 9 24 35 | 80 | | -/1 | 34-34.3' Orange-brown SAND, fine to medium grained, some coarse sand and silt, moderately sorted, firm, slightly moist. |
| 36 | | | | | | | 34.3-34.6' Dark brown silty SAND (hardpan), silt (35-40%), moist. |
| 38 | ▼ | X | 7 7 8 9 | 0 | | -/1 | 34.6-48' Light tannish brown SAND, very fine to fine grained, little coarse sand and gravel in spoon, somewhat firm, saturated at 35.5'. |
| 40 | grout seal | | | | | | |
| 42 | | | | | | | |
| 44 | | X | 7 7 9 9 | 80 | | 3/4 | |
| 46 | | | | | | | |
| 48 | | X | 40 15 10 18 | 85 | | 4/4 | 48-58' brown SAND, fine to medium grained, little to some (20%) quartz pebbles and gravel, iron rich (hardpan) layer from 48.9-49.1, little silt, firm, wet. |
| 50 | | | | | | | |
| 52 | | | | | | | |
| 54 | | X | 12 24 20 16 | 75 | | 1/1 | |
| 56 | | | | | | | |



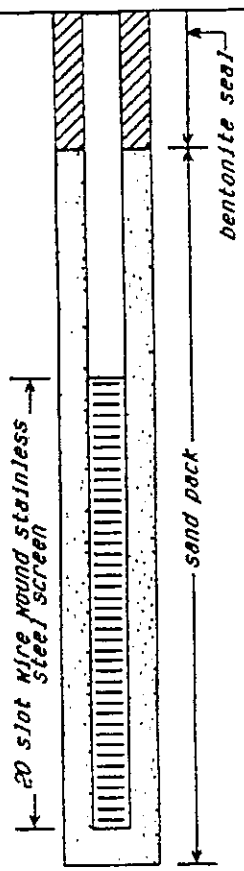
AR306592

# MONITOR WELL



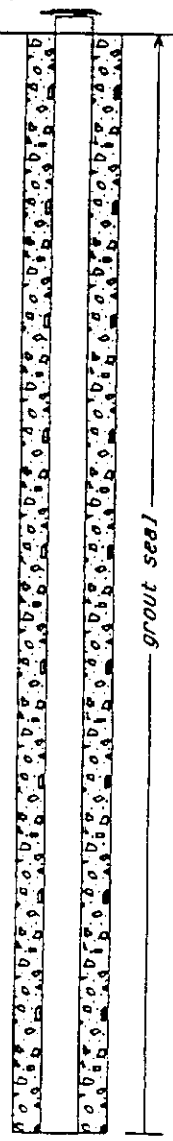
PROJECT STANDARD CHLORINE WELL NUMBER MW-01

| DEPTH IN FEET | WELL CONSTRUCTION DETAIL | SAMPLE INTERVAL | BLOW COUNT | % RECOVERY | GRAPHIC SYMBOL | HNU/OVA READING | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| 56 | | | | | | | |
| 58 | | X | 10 11 12 15 25 | 67 | | 2/2 | 58-65' Orange brown to tannish brown SAND, fine to coarse grained, some silt, poorly sorted, firm, wet, slight odor. |
| 60 | | | | | | | |
| 62 | | | | | | | |
| 64 | | X | 13 15 15 20 20 | 73 | | -/12 | |
| 66 | | X | 13 15 20 24 | 55 | | 4/12 | 65-67.8' Light tannish brown SAND, fine to medium grained, some coarse sand, trace silt and hardpan, firm, wet, slight odor. |
| 68 | | X | 20 24 40 45 | 63 | | 15/5 | 67.8-67.9' Reddish-brown HARDPAN, iron rich layer, friable, wet. |
| 70 | | X | 15 15 17 22 30 | 60 | | 60/60 | 67.9-69' Brown silty SAND, very fine to fi[illegible] grained, silt approx. 35-40%, tra[illegible] coarse to very coarse sand, wet, od[illegible] |
| 72 | | X | 8 18 18 18 20 | 75 | | -/800 | 69-72' Light grayish-brown to orange brown SILT, trace to little very fine sand, trace gray clay lens @ 71.65', wet, odor. |
| 74 | | X | 15 17 20 22 22 | 90 | | >1000/100 | 72-73.8' Gray to black SILT, lithologically like previous interval but discolored, very strong odor, saturated (product?). |
| 76 | | | | | | | 73.8-74.6' Gray CLAY, dense, somewhat plastic, moist. |
| 78 | | | | | | | 74.6-74.8' Reddish-gray CLAY, trace silt, dense, firm, dry to slightly moist. |
| 80 | | | | | | | |
| 82 | | | | | | | |
| 84 | | | | | | | |
| 86 | | | | | | | |
| 88 | | | | | | | |



# MONITOR WELL

| | | | |
|---|---|---|---|
| Project | STANDARD CHLORINE | Well Number | MW-02 |
| Location | DELAWARE CITY, DE | Coordinates | 583483.92 N; 438583.24 E |
| Geologist | D. Cairns | Top of Casing Elevation | 48.35 feet |
| Drilling Contractor | JCA | Groundsurface Elevation | 46.87 feet |
| Driller | Joe Jester | Total Borehole Depth | 67 feet |
| Drilling Method | Hollow stem auger | Total Well Depth | 60.63 feet |
| Diameter of Borehole | 12 inches | Date Started | 1/26/90 |
| Diameter of Well Casing | 4 inches | Date Well Completed | 1/27/90 |

| DEPTH IN FEET | WELL CONSTRUCTION DETAIL | SAMPLE INTERVAL | BLOW COUNT | RECOVERY | GRAPHIC SYMBOL | HNU/OVA READING | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| 0 |  | X | 1 1 2 5 3 | 60 | | BKG/BKG | 0-0.7' Brown clayey LOAM, trace to little SAND, fine grained, trace roots, moist. |
| 2 | | | | | | | 0.7-5' Orange-brown sandy LOAM, sand, fine to medium grained, some clay and silt, moist. |
| 4 | | | | | | | |
| 6 | | | | | | | 5-13.7' light tannish-brown to orange-brown SAND, fine to coarse grained, little to some silt, moderately to poorly sorted - becoming coarser through interval, somewhat loose, moist. |
| 8 | | X | 5 5 5 7 | 68 | | -/- | |
| 10 | | | | | | | |
| 12 | | | | | | | |
| 14 | | X | 3 4 4 4 5 | 65 | | -/- | 13.7-23' Orange-brown SAND, fine to medium grained, trace to little coarse sand, bands of dark orange-brown and light orange-brown, moist. |
| 16 | | | | | | | |
| 18 | | X | 5 5 5 5 5 | 88 | | -/- | |
| 20 | | | | | | | |
| 22 | | | | | | | |
| 24 | | X | 4 5 | 70 | | BKG/BKG | 23-43' Alternating beds of tannish-brown and orange-brown SAND, fine to medium grained, little (10%) silt, trace |

grout seal

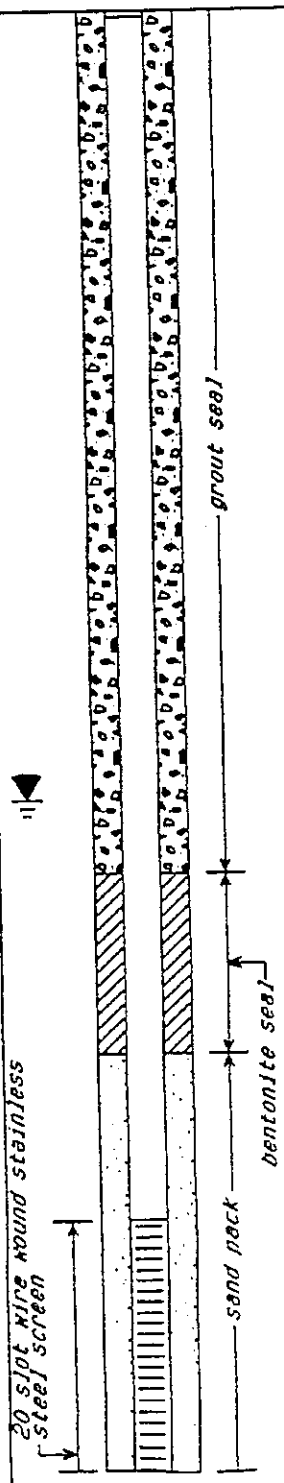
# MONITOR WELL



PROJECT STANDARD CHLORINE WELL NUMBER MW-02

| DEPTH IN FEET | SAMPLE INTERVAL | BLOW COUNT | % RECOVERY | GRAPHIC SYMBOL | HNU/OVA READINGS | DESCRIPTION |
|---|---|---|---|---|---|---|
| 24 | X | 5 7 | 70 | | BKG/BKG | coarse sand and fine black sand - occurs in "pockets", somewhat loose, increasing moisture % through interval. |
| 26 | | | | | | |
| 28 | X | 11 12 13 14 15 | 90 | | BKG/BKG | |
| 30 | | | | | | |
| 32 | | | | | | |
| 34 | X | 6 7 12 14 | 75 | | BKG/BKG | |
| 36 | | | | | | |
| 38 | X | 8 9 10 12 | 93 | | 1/0.5 | WET at 39.5' BGS. |
| 40 | | | | | | |
| 42 | | | | | | |
| 44 | X | 8 12 13 15 | 63 | | 0.5/3 | 43-48.4' light to medium orange brown SAND, fine to medium, trace to little silt, dense, saturated. |
| 46 | | | | | | |
| 48 | X | 9 10 14 17 | 88 | | 1/3 | 48.4-53.1' Light orange-brown to tannish-brown gravelly SAND, fine to coarse grained, some very fine sand and silt, poorly sorted, saturated, slight odor. |
| 50 | | | | | | |
| 52 | | | | | | |
| 54 | X | 14 17 15 19 | 85 | | -/15 | 53.1-53.5' interbedded orange-brown SAND, medium grained, and black SAND (very fine to fine), and SILT, dense, saturated, slight odor. |
| 56 | | | | | | 53.5-63' Light tannish-brown SAND, fine to medium grained, little (<10%) dark |

WELL CONSTRUCTION DETAIL






AR306595

# MONITOR WELL

PROJECT STANDARD CHLORINE WELL NUMBER MW-02

| DEPTH IN FEET | WELL CONSTRUCTION DETAIL | SAMPLE INTERVAL | BLOW COUNT | % RECOVERY | GRAPHIC SYMBOL | HNU/OVA READING | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| 56 | | | | | | | brown to black silt, trace black sand, very fine, present in "pockets" through spoon, poorly sorted, dense, wet. |
| 58 | sand pack | | | | | | |
| | | X | 12 14 15 19 | 75 | | -/4 | 63-63.5' Light brown silty SAND, very fine grained, somewhat dense, wet, odor. |
| 60 | | | | | | | 63.5-63.9' Brown silty CLAY, some lenses of brown sand, very fine, wet. |
| 62 | | | | | | | 63.9-64' Gray SAND, very fine grained, somewhat loose, wet contact at 64' BGS with clay. |
| 64 | | X | 4 7 11 15 | 73 | | -/20 | 64-65.3' Gray CLAY, dense-firm, slightly plastic, dry to slightly moist (MERCHANTVILLE). |
| 66 | | X | 7 12 20 20 | 55 | | -/2 | 67' Gray and red CLAY, in very bottom of spoon. (POTOMAC). |
| 68 | | | | | | | |
| 70 | | | | | | | |
| 72 | | | | | | | |
| 74 | | | | | | | |
| 76 | | | | | | | |
| 78 | | | | | | | |
| 80 | | | | | | | |
| 82 | | | | | | | |
| 84 | | | | | | | |
| 86 | | | | | | | |
| 88 | | | | | | | |



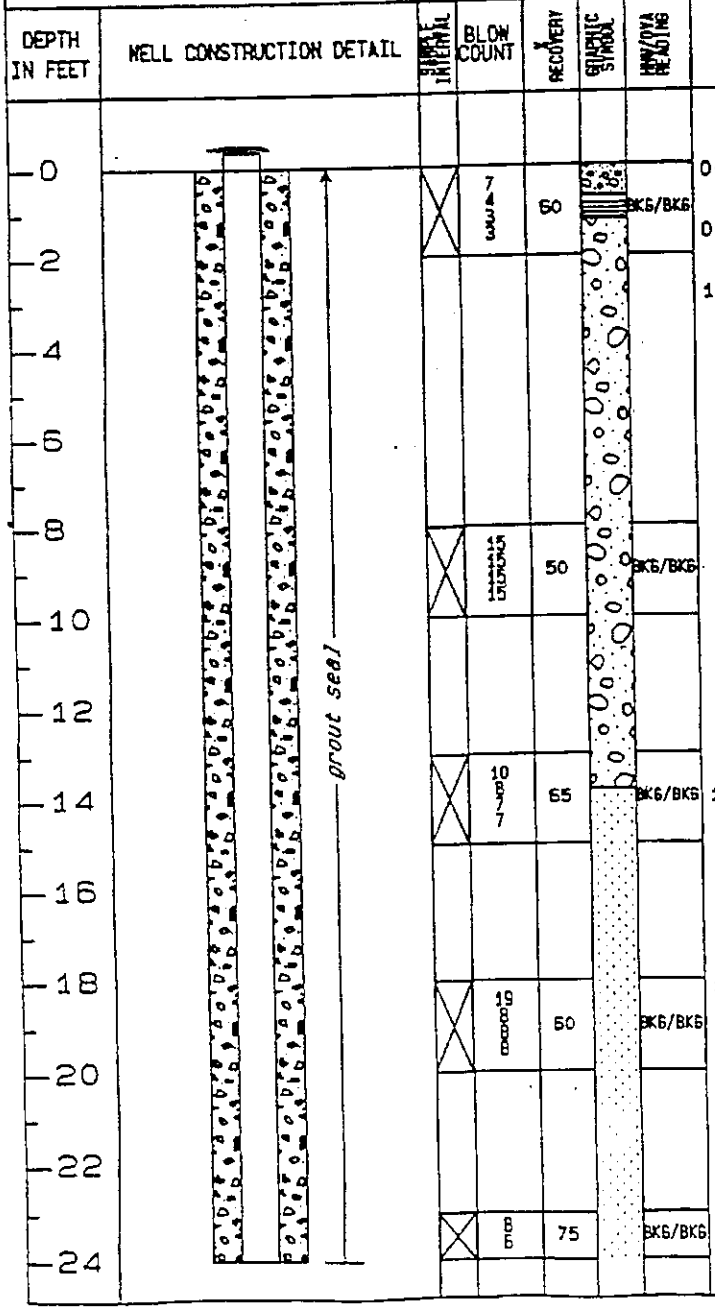
AR306596

# MONITOR WELL



Project: STANDARD CHLORINE
Location: DELAWARE CITY, DE.
Geologist: D. Cairns
Drilling Contractor: JCA
Driller: Joe Jester
Drilling Method: Hollow stem auger
Diameter of Borehole: 12 inches
Diameter of Well Casing: 4 inches

Well Number: MW-03
Coordinates: 583572.13 N; 438321.26 E
Top of Casing Elevation: 50.23 feet
Groundsurface Elevation: 47.74 feet
Total Borehole Depth: 66.9 feet
Total Well Depth: 61.59 feet
Date Started: 1/29/90
Date Well Completed: 1/30/90




0-0.7' Dark brown clayey LOAM, high in organics, moist.

0.7-1.2' Light brown-orange CLAY/SILT, low plasticity, firm, moist.

1.2-13.8' Light brown SAND and GRAVEL, trace yellow-white sand, fine grained, iron rich layer, poorly sorted, dry to slightly moist.

13.8-18' Orange SAND, medium to coarse grained, trace gravel to 0.25" in diameter, subangular, poorly sorted, moist.

18-23' Light brown to orange SAND, fine to medium, some bands of darker orange-brown SAND, poorly sorted, loose, dry.

23-28' Light orange SAND, fine to coarse with some bands of silty SAND, very fine, some coarse sand, poorly sorted, loose, dry.



AR306597

# MONITOR WELL

PROJECT STANDARD CHLORINE WELL NUMBER MW-03

| DEPTH IN FEET | WELL CONSTRUCTION DETAIL | SAMPLE INTERVAL | BLOW COUNT | % RECOVERY | GRAPHIC SYMBOL | HNU/OVA READING | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| 24 | | X | 6 9 | 75 | | BKG/BKG | |
| 26 | | | | | | | |
| 28 | | X | 20 13 11 10 | 30 | | BKG/BKG | 28-34.1' Light brown to white SAND, medium to coarse grained, trace quartz gravel, poorly sorted, loose, dry. |
| 30 | | | | | | | |
| 32 | | | | | | | |
| 34 | | X | 9 9 9 9 | 85 | | BKG/1 | 34.1-44' Brown to dark brown SAND, fine to medium grained, rust colored, some black sand in lenses throughout interval, somewhat dense, trace iron oxide (hardpan) pebbles in interval, moderately well sorted, moist to wet at 41' BGS. |
| 36 | | | | | | | |
| 38 | | X | 15 14 12 12 | 65 | | BKG/BKG | |
| 40 | | | | | | | |
| 42 | | | | | | | |
| 44 | | X | 10 12 12 14 | 88 | | -/150 | 44-44.1' Black SAND, fine to coarse, little silt, poorly sorted, odor, wet. |
| 46 | | | | | | | 44.1-48' Brown SAND, medium to coarse grained, trace to little silt, saturated, odor, high OVA ~ 150ppm. |
| 48 | | X | 12 13 14 14 | 85 | | -/250 | 48-53' Light orange-brown SAND, fine to medium grained, trace to little lenses of black sand, fine to medium grained, somewhat loose, odor, wet. |
| 50 | | | | | | | |
| 52 | | | | | | | |
| 54 | | X | 12 14 16 19 | 60 | | -/80 | 53-58' Light brown SAND, fine to medium grained moderately well sorted, saturated. |
| 56 | | | | | | | |

grout seal

bentonite seal

sand pack



AR306598

# MONITOR WELL



PROJECT STANDARD CHLORINE WELL NUMBER MW-03

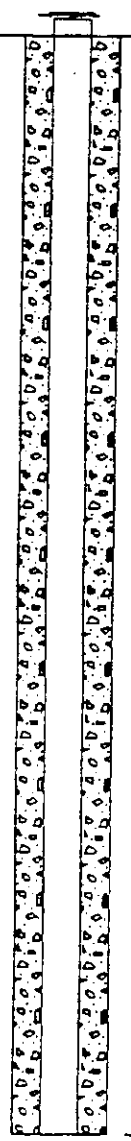
| DEPTH IN FEET | WELL CONSTRUCTION DETAIL | SAMPLE INTERVAL | BLOW COUNT | % RECOVERY | GRAPHIC SYMBOL | HNU/OVA READING | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| 56 | | | | | | | |
| 58 | 20 slot wire wound stainless steel screen; sand pack | X | 14 21 17 22 | 85 | | -/40 | 58-63' Light brown SAND, fine to very coarse grained, some quartz pebbles through interval, somewhat dense, poorly sorted, wet. |
| 60 | | | | | | | |
| 62 | | | | | | | |
| 64 | | X | 9 14 45 75 | - | | -/- | 63-65' SAND and GRAVEL, very poor recovery, loose, wet. |
| 66 | | X | 27 32 35 34 20 | 95 | | -/0-20 | 65-65.9' Light orange-brown sandy CLAY, some gray-black lenses of sandy CLAY, slightly plastic, dense, moist. |
| | | | | | | | 65.9-66.5' Orange-brown SAND, fine grained, grading to a gray CLAY, sand well sorted, firm, moist to wet. |
| | | | | | | | 66.5-66.9' Gray CLAY, dense, slightly plast[illegible] some red bands in bottom of spoo[illegible] moist to wet. |
| 68 | | | | | | | |
| 70 | | | | | | | |
| 72 | | | | | | | |
| 74 | | | | | | | |
| 76 | | | | | | | |
| 78 | | | | | | | |
| 80 | | | | | | | |
| 82 | | | | | | | |
| 84 | | | | | | | |
| 86 | | | | | | | |
| 88 | | | | | | | |



AR306599

# MONITOR WELL

| | | | |
|---|---|---|---|
| Project | STANDARD CHLORINE | Well Number | MW-04 |
| Location | DELAWARE CITY, DE. | Coordinates | |
| Geologist | D. Cairns | Top of Casing Elevation | 55.22 feet |
| Drilling Contractor | JCA | Groundsurface Elevation | 52.74 feet |
| Driller | Joe Jester | Total Borehole Depth | 72.5 feet |
| Drilling Method | Hollow stem auger | Total Well Depth | 69.5 feet |
| Diameter of Borehole | 12 inches | Date Started | 1/31/90 |
| Diameter of Well Casing | 4 inches | Date Well Completed | 2/1/90 |

| DEPTH IN FEET | WELL CONSTRUCTION DETAIL | SAMPLE INTERVAL | BLOW COUNT | % RECOVERY | GRAPHIC SYMBOL | HNU/OVA READING | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| 0 |  | X | 9 16 7 12 | 63 | | -/BKG | 0-3' Dark brown silty CLAY, trace brown sand, very fine grained, some organics - grass and roots at ground surface, brittle, dry. |
| 2 | | | | | | | |
| 4 | | | | | | | 3-18' Light brown to orange-brown SAND, fine to medium grained, and GRAVEL, trace to little (>10%) silt, gravel, predominantly quartz, trace iron oxide staining, loose, slightly moist. |
| 6 | | | | | | | |
| 8 | | X | 5 6 7 9 | 63 | | -/0.5 | |
| 10 | | | | | | | |
| 12 | | | | | | | |
| 14 | | X | 22 18 17 15 | 48 | | -/1 | |
| 16 | | | | | | | |
| 18 | | X | 5 5 5 5 | 70 | | -/0.5 | 18-18.4' Light tannish-brown SAND, fine to very coarse grained, some quartz pebbles and gravel, poorly sorted, loose, slightly moist. |
| 20 | | | | | | | |
| 22 | | | | | | | 18.4-24.1' Light orangish-brown (rusty) SAND, fine to medium grained, trace coarse sand, moderately sorted, loose, slightly moist. |
| 24 | | X | 8 7 | 78 | | -/0 | |

grout seal

# MONITOR WELL



PROJECT STANDARD CHLORINE WELL NUMBER MW-04

| DEPTH IN FEET | WELL CONSTRUCTION DETAIL | SAMPLE INTERVAL | BLOW COUNT | % RECOVERY | GRAPHIC SYMBOL | HNU/OVA READING | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| 24 | | X | 8 9 | 78 | | -/0 | 24.1-24.4' Light tannish brown SAND, fine to medium grained, moderately sorted, loose, moist. |
| 26 | | | | | | | 24.4-29.1' Light orange-brown SAND, same as 18.4-24.1' interval. |
| 28 | | X | 10 11 7 5 | 75 | | -/0.5 | 29.1-29.2' Orange-brown HARDPAN layer, fine to very coarse, poorly sorted, slightly moist. |
| 30 | | | | | | | |
| 32 | | | | | | | 29.2-43' Light orange-brown SAND, fine to medium grained, little (>10%) silt, little (>10%) lenses of black sand (very fine grained), throughout interval, moderately well sorted, moist. |
| 34 | | X | 7 8 8 9 | 83 | | -/BKG | |
| 36 | grout seal | | | | | | |
| 38 | | X | 8 10 10 9 | 80 | | -/1 | |
| 40 | | | | | | | |
| 42 | | | | | | | |
| 44 | | X | 7 8 8 8 | 90 | | -/0 | 43-53' Light orange-brown to light brown SAND, fine to medium grained, trace silt and black sand, very fine, well sorted, moist to wet at 46.5' BGS. |
| 46 | | | | | | | |
| 48 | ▼ | X | 7 10 10 8 | 95 | | -/10-50 | |
| 50 | bentonite seal | | | | | | |
| 52 | | | | | | | |
| 54 | | X | 6 12 18 18 | 70 | | 10-20/ 20-40 | 53-58.5' Medium grained rusty-brown SAND, fine to medium grained, trace coarse sand and very fine black sand, well sorted, wet. |
| 56 | | | | | | | |



AR306601

# MONITOR WELL

PROJECT STANDARD CHLORINE WELL NUMBER MW-04

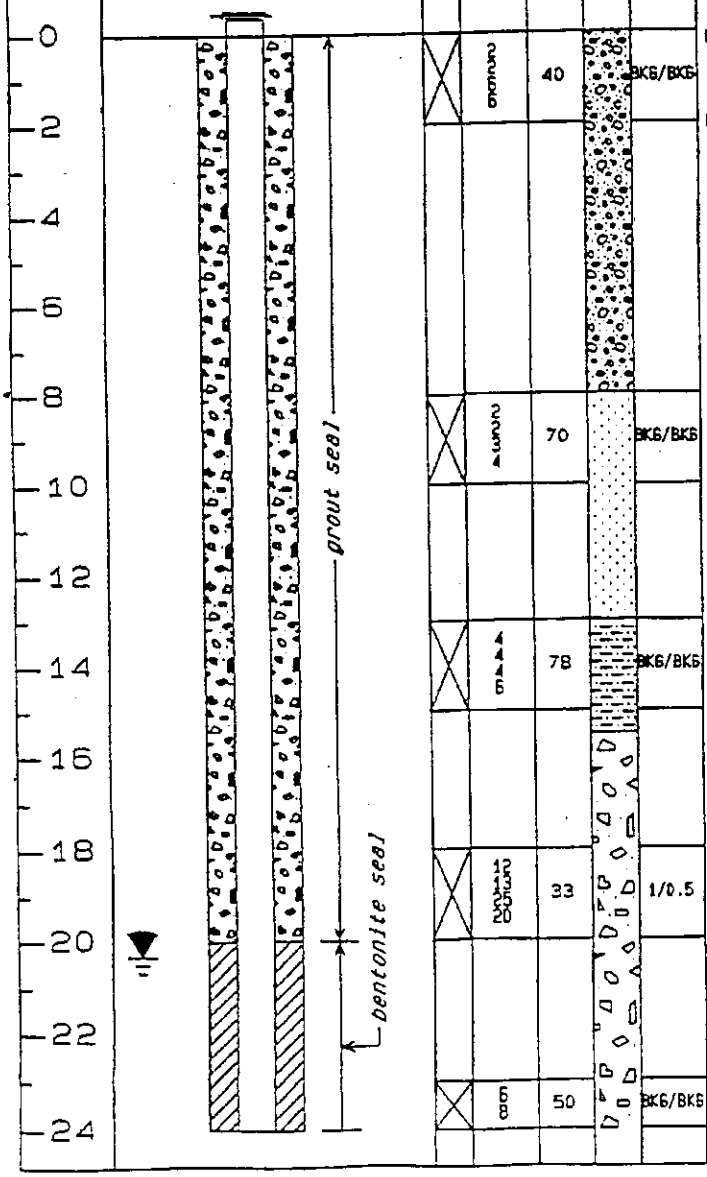
| DEPTH IN FEET | WELL CONSTRUCTION DETAIL | SAMPLE INTERVAL | BLOW COUNT | % RECOVERY | GRAPHIC SYMBOL | HNU/OVA READING | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| 56 | | | | | | | |
| 58 | | X | 10 10 11 10 | 85 | | 100/200 | 58.5-63' Orange-brown SAND, fine to medium grained, bands of light to dark orange brown, some coarse sand and black sand, fine grained, strong odor, wet. |
| 60 | 20 slot wire wound stainless steel screen; sand pack | | | | | | |
| 62 | | | | | | | |
| 64 | | X | 7 11 12 13 15 | 68 | | 20/40 | 63-70' Light tannish brown SAND, fine to medium grained, some silt, trace black sand, very fine to fine, well sorted, dense, wet. |
| 66 | | X | 15 20 26 27 | 83 | | 70/80 | |
| 68 | | | | | | | |
| 70 | | X | 20 33 33 38 | 90 | | 20/50 | 70-71.1' Light brown SAND, very fine to fine grained, (30%) silt, well sorted, wet. |
| 72 | | X | - | 100 | | -/50 | 71.1-71.4' Light tan-gray clayey SILT, trace (<5%) sand, very fine grained, friable, wet. |
| 74 | | | | | | | 71.4-72.5' Light brown SAND, very fine grained, little silt, dense, very well sorted odor, wet. |
| 76 | | | | | | | |
| 78 | | | | | | | |
| 80 | | | | | | | |
| 82 | | | | | | | |
| 84 | | | | | | | |
| 86 | | | | | | | |
| 88 | | | | | | | |



AR306602

# MONITOR WELL

| | | | |
|---|---|---|---|
| Project | STANDARD CHLORINE | Well Number | MW-05 |
| Location | DELAWARE CITY, DE. | Coordinates | 583641.80 N; 438804.94 E |
| Geologist | D. Cairns | Top of Casing Elevation | 25.36 feet |
| Drilling Contractor | JCA | Groundsurface Elevation | 23.31 feet |
| Driller | Joe Jester | Total Borehole Depth | 44 feet |
| Drilling Method | Hollow stem auger | Total Well Depth | 41 feet |
| Diameter of Borehole | 12 inches | Date Started | 2/5/90 |
| Diameter of Well Casing | 4 inches | Date Well Completed | 2/5/90 |




0-0.4' Dark brown silty LOAM, little sand and clay, high in organics, some roots and pebbles, moist.

0.4-8' Brown clayey LOAM, some sand, fine to coarse, little silt, trace pebbles, moist.

8-8.4' Orange-brown SAND, very fine to fine, little silt, somewhat loose, moist.

8.4-13' Light tannish brown to orange brown SAND, fine to medium grained, some silt, moderately sorted, loose, moist.

13-15.5' Light orange-brown to dark rusty brown SAND, very fine to medium grained, some silt, trace coarse sand, poorly sorted, loose, slightly moist.

15.5-23' Light orange-brown SAND (fine to coarse), and GRAVEL, quartz gravel and hardpan, trace to little silt, very poorly sorted, wet at 18'BGS.

23-28.6' Light tannish brown SAND, fine to coarse, some very coarse sand and quartz pebbles, very poorly sorted, loose, saturated.

# MONITOR WELL

PROJECT STANDARD CHLORINE WELL NUMBER MW-05

| DEPTH IN FEET | WELL CONSTRUCTION DETAIL | SAMPLE INTERVAL | BLOW COUNT | % RECOVERY | GRAPHIC SYMBOL | HNU/OVA READING | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| 24 | | X | 9 11 | 50 | | BKG/BKG | |
| 26 | | | | | | | |
| 28 | | X | 6 8 11 16 | 60 | | 0.5/1 | 28.6-28.7' Black silty SAND, fine to medium grained, little clay, saturated. |
| 30 | | | | | | | 28.7-40.6' Light tannish brown SAND, fine to coarse, little silt and black sand, fine grained, somewhat loose, saturated. |
| 32 | 20 slot wire wound stainless steel screen; sand pack | | | | | | |
| 34 | | X | 8 9 11 14 | 65 | | 5/2 | |
| 36 | | | | | | | |
| 38 | | X | 5 8 7 15 | 60 | | 8/10 | 40.6-41' Dark orange-brown to black (Fe-oxide) SAND and PEBBLES, poorly sorted, dense, saturated. |
| 40 | | X | 5 10 13 18 | 65 | | 10/10 | 41-43.2' Light gray, with red streaks, CLAY, little (10%) silt and sand, very fine to fine, plastic, dense, moist (POTOMAC). |
| 42 | | X | 10 12 15 14 | 60 | | BKG/BKG | |
| 44 | | | | | | | |
| 46 | | | | | | | |
| 48 | | | | | | | |
| 50 | | | | | | | |
| 52 | | | | | | | |
| 54 | | | | | | | |
| 56 | | | | | | | |

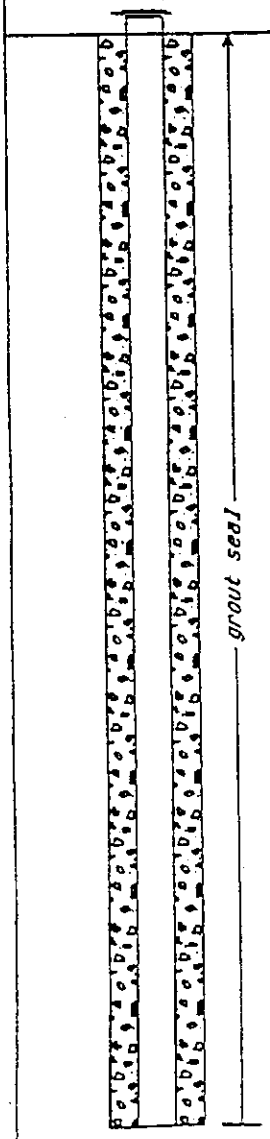


AR306604

# MONITOR WELL

Project STANDARD CHLORINE
Location DELAWARE CITY, DE.
Geologist D. Cairns
Drilling Contractor JCA
Driller Joe Jester
Drilling Method Hollow stem auger
Diameter of Borehole 12 inches
Diameter of Well Casing 4 inches

Well Number MW-06
Coordinates 583899.42 N: 438451.45
Top of Casing Elevation 51.43 feet
Groundsurface Elevation 48.58 feet
Total Borehole Depth 70.4 feet
Total Well Depth 67.28 feet
Date Started 1/18/90
Date Well Completed 1/19/90

| DEPTH IN FEET | WELL CONSTRUCTION DETAIL | SAMPLE INTERVAL | BLOW COUNT | % RECOVERY | GRAPHIC SYMBOL | HNU/OVA READING | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| 0 |  | X | 2 3 3 4 | 60 | | BKG/BKG | 0-5' Medium brown CLAYEY LOAM, little silt, trace sand (fine to medium grained) and pebbles, slightly plastic, moist. |
| 2 | | | | | | | |
| 4 | | | | | | | |
| 6 | | X | 9 12 13 10 | 63 | | BKG/BKG | 5-10' Light orange-brown SAND and GRAVEL, gravel predominantly quartz - trace reddish-brown mudstone-hardpan, very poorly sorted, somewhat dense, slightly moist. |
| 8 | | | | | | | |
| 10 | | X | GRAVELS | 55 | | BKG/BKG | 10-20' Light orange-brown gravelly SAND, coarse grained, gravel - predominantly quartz, well rounded, moderately sorted, loose, slightly moist.. |
| 12 | | | | | | | |
| 14 | | | | | | | |
| 16 | | X | 7 9 12 12 | 45 | | BKG/BKG | |
| 18 | | | | | | | - very gravelly to 17.5'BGS, based upon auger performance. |
| 20 | | X | 8 11 13 19 | 90 | | BKG/BKG | 20-20.1' brown SAND, medium grained, slightly moist, contact at 20.1' BGS. |
| 22 | | | | | | | 20.1-21.2' Brown CLAY, brittle, crumbly-dry, non-plastic. |
| 24 | | | | | | | 21.2-25.7' Light orange-brown to grayish-br SAND, fine to medium grained, moderately well sorted, somewhat dense, grades to a coarse grained |

grout seal



AR306605

# MONITOR WELL

PROJECT STANDARD CHLORINE WELL NUMBER MW-06

| DEPTH IN FEET | WELL CONSTRUCTION DETAIL | SAMPLE INTERVAL | BLOW COUNT | % RECOVERY | GRAPHIC SYMBOL | HNU/OVA READING | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| 24 | | | | | | | sand at bottom, slightly moist to dry. |
| 26 | | X | 7 5 7 12 | 75 | | BKG/BKG | 25.7-40' Light orange brown to gray-white SAND, fine to medium grained, trace to little black sand (fine) and silt, somewhat dense, slightly moist to moist. |
| 28 | | | | | | | |
| 30 | | X | 9 7 12 17 | 75 | | BKG/BKG | |
| 32 | | | | | | | |
| 34 | | | | | | | |
| 36 | | X | 12 7 7 9 | 85 | | BKG/BKG | |
| 38 | | | | | | | |
| 40 | | X | 9 10 10 11 | 82 | | BKG/BKG | 40-40.2' Reddish-brown to black PEBBLES, (hardpan), high in iron content, slightly moist. |
| 42 | | | | | | | 40.2-50' Orange-brown SAND, fine to medium grained, trace to little silt, trace black sand, fine grained, increased moisture content through interval, wet at 43' BGS. |
| 44 | | | | | | | |
| 46 | | X | 9 9 9 20 | 85 | | 6/6 | |
| 48 | | | | | | | |
| 50 | | X | 13 14 20 13 | 82 | | 40/120 | 50-51' Brown SAND, fine to medium grained, trace coarse sand and pebbles, wet. |
| 52 | | | | | | | 51-56.1' Orange-brown SAND, fine to medium grained, some coarse and very coarse sand, little pebbles in matrix, dense, odor, saturated. |
| 54 | | | | | | | |
| 56 | | X | 21 51 34 | 77 | | 20/80 | |

grout seal

bentonite seal

sand pack



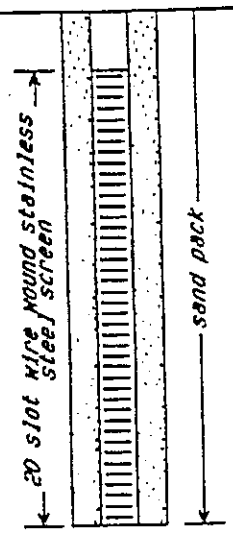
AR306606

# MONITOR WELL



PROJECT STANDARD CHLORINE WELL NUMBER MW-06

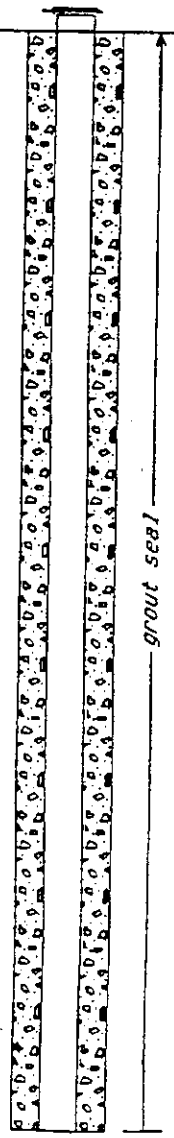
| DEPTH IN FEET | WELL CONSTRUCTION DETAIL | SAMPLE INTERVAL | BLOW COUNT | % RECOVERY | GRAPHIC SYMBOL | HNU/OVA READING | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| 56 | | X | 45 53 | 77 | | 20/80 | 56.1-65' Tannish-brown SAND, fine to coarse, some pebbles and black sand, medium grained, strong odor, somewhat dense - becoming loose through interval, wet. |
| 58 | | X | 10 9 11 19 | 60 | | 30/70 | |
| 60 | | X | 7 11 14 15 | 57 | | 4/15 | |
| 62 | | X | 5 6 11 19 | 81 | | 20/75 | |
| 64 | | X | 3 5 11 15 | 85 | | 50/200 | |
| 66 | | X | 18 50 30 20 | 68 | | 180/180 | 65-67.3' Orange brown SAND, fine to coarse grained, trace pebbles and gravel, moderately sorted, some iron staining on pebbles, wet. |
| 68 | | X | 11 16 26 50 | 70 | | 60/70 | 67.3-69' Tannish-brown to reddish-brown clayey SILT to silty CLAY, trace very fine grained sand, alternating beds of silt and clay, loose, dry to slightly moist. |
| 70 | | X | 20 35 | 100 | | 30/60 | 69-69.2' Red and white CLAY, plastic, dense. |
| 72 | | | | | | | 69.2-70.4' Light tannish-white SAND, very fine to fine grained, very well sorted, moist to wet. |
| 74 | | | | | | | |
| 76 | | | | | | | |
| 78 | | | | | | | |
| 80 | | | | | | | |
| 82 | | | | | | | |
| 84 | | | | | | | |
| 86 | | | | | | | |
| 88 | | | | | | | |



# MONITOR WELL

Project STANDARD CHLORINE
Location DELAWARE CITY, DE.
Geologist D. Cairns
Drilling Contractor JCA
Driller Joe Jester
Drilling Method Hollow stem auger
Diameter of Borehole 12 inches
Diameter of Well Casing 4 inches

Well Number MW-07
Coordinates 583937.15 N; 438205.85 E
Top of Casing Elevation 48.92 feet
Groundsurface Elevation 46.74 feet
Total Borehole Depth 61.3 feet
Total Well Depth 57.35 feet
Date Started 1/16/90
Date Well Completed 1/17/90

| DEPTH IN FEET | WELL CONSTRUCTION DETAIL | SAMPLE INTERVAL | BLOW COUNT | RECOVERY % | GRAPHIC SYMBOL | HNU/OVA READING | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| 0 |  | X | 7 9 9 14 | 37 | | BKG/BKG | 0-5' Medium brown silty LOAM, little to some coarse sand, somewhat dense, wet-moist. |
| 2 | | | | | | | |
| 4 | | | | | | | - Gravel layer at 3' BGS, based on auger performance. |
| 6 | | X | 10 8 6 6 | 72 | | BKG/BKG | 5-11.2' Light orangish-brown SAND, medium grained, little silt and gravel based on auger performance, well sorted, dense, moist. |
| 8 | | | | | | | |
| 10 | | | | | | | |
| 12 | | X | 2 3 4 5 | 82 | | BKG/BKG | 11.2-20' Dark orange-brown SAND, fine to coarse grained, trace pebbles and black sand, somewhat loose, moist. |
| 14 | | | | | | | |
| 16 | | X | 5 5 4 5 | 80 | | BKG/3 | |
| 18 | | | | | | | |
| 20 | | X | 6 5 5 8 | 70 | | BKG/2 | 20-25.4' Light orange-brown SAND, fine to coarse grained, some coarse to very coarse layers of sand, also some lenses of brown to black sand (coarse), slightly moist. |
| 22 | | | | | | | |
| 24 | | | | | | | |

grout seal



AR306608

# MONITOR WELL



PROJECT STANDARD CHLORINE WELL NUMBER MW-07

| DEPTH IN FEET | WELL CONSTRUCTION DETAIL | SAMPLE INTERVAL | BLOW COUNT | % RECOVERY | GRAPHIC SYMBOL | HNU/OVA READING | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| 24 | | | | | | | |
| 26 | | X | 6 6 10 10 | 87 | | BKG/BKG | 25.4-25.6' Reddish-brown SAND and PEBBLES (hardpan), iron rich layer, slightly moist to dry. |
| 28 | | | | | | | 25.6-30.2' Light orange-brown SAND, same as 20-25.4' interval. |
| 30 | | X | 9 10 10 11 | 70 | | BKG/2 | 30.2-30.7' Light brown SAND and sandy CLAY, some pebbles and black sand, brittle, dry. |
| 32 | | | | | | | 30.7-40' Light brown SAND, fine to medium grained, with some layers of orange brown SAND, coarse grained, trace black sand, fine to medium grained, loose, moist. |
| 34 | | | | | | | |
| 36 | grout seal | X | 5 5 5 5 | 92 | | BKG/BKG | |
| 38 | bentonite seal | | | | | | |
| 40 | | X | 5 5 5 5 | 87 | | BKG/1 | 40-58.9' Light brown SAND, fine to coarse grained, trace to little (10%) lenses of orange-brown sand and black sand, fine, poorly sorted, high OVA and HNU readings through interval, wet at 40.7' BGS. |
| 42 | | | | | | | |
| 44 | | | | | | | |
| 46 | | X | 4 8 10 10 | 95 | | 5/20 | |
| 48 | sand pack | | | | | | |
| 50 | | X | 6 4 6 10 | 95 | | 30/30 | |
| 52 | | X | 5 9 11 15 | 92 | | 220/250 | |
| 54 | 20 slot wire wound stainless steel screen | X | 6 9 11 11 | 95 | | 200/300 | |
| 56 | | | | | | | |

# MONITOR WELL

PROJECT STANDARD CHLORINE WELL NUMBER MW-07

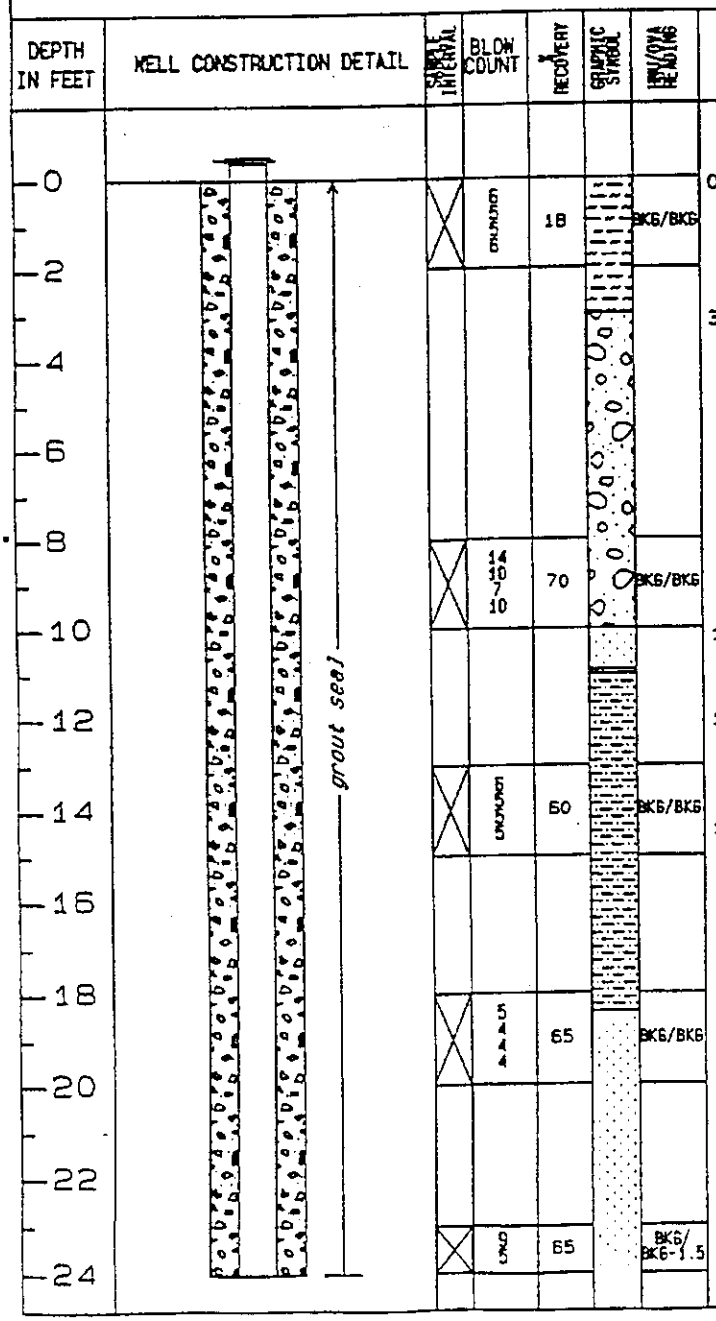
| DEPTH IN FEET | WELL CONSTRUCTION DETAIL | SAMPLE INTERVAL | BLOW COUNT | % RECOVERY | GRAPHIC SYMBOL | HNU/OVA READING | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| 56 | | | | | | | |
| | | X | 6 9 11 14 | 90 | | 50/300 | |
| 58 | | X | 8 10 15 15 | 80 | | 60/80 | 58.9-59.6' Light orange CLAY, some sand, fine to medium grained, somewhat dense, moist, thin (0.05') layer with coarse sand at 59.15'BGS. |
| 60 | | X | 20 30 45 60 | 65 | | 10-30/60 | |
| 62 | | | | | | | 59.6-60.8' Red to light gray sandy CLAY, soft, sand, very fine to fine, wet, weak odor. |
| 64 | | | | | | | 60.8-61.3' Light brown / orange brown SAND, very fine grained, well sorted, saturated. |
| 66 | | | | | | | * Augers plugged up in bottom, used roller bit to clean out. |
| 68 | | | | | | | Total depth 61.3' BGS. |
| 70 | | | | | | | |
| 72 | | | | | | | |
| 74 | | | | | | | |
| 76 | | | | | | | |
| 78 | | | | | | | |
| 80 | | | | | | | |
| 82 | | | | | | | |
| 84 | | | | | | | |
| 86 | | | | | | | |
| 88 | | | | | | | |



AR306610

# MONITOR WELL

| | | | |
|---|---|---|---|
| Project | STANDARD CHLORINE | Well Number | MW-08 |
| Location | DELAWARE CITY, DE. | Coordinates | 583642.69 N; 437827.81 |
| Geologist | D. Cairns | Top of Casing Elevation | 43.22 feet |
| Drilling Contractor | JCA | Groundsurface Elevation | 41.60 feet |
| Driller | Joe Jester | Total Borehole Depth | 55 feet |
| Drilling Method | Hollow stem auger | Total Well Depth | 51 feet |
| Diameter of Borehole | 12 inches | Date Started | 1/24/90 |
| Diameter of Well Casing | 4 inches | Date Well Completed | 1/24/90 |




0-3' Medium to dark brown clayey LOAM, some silt and sand, fine to coarse grained, poorly sorted, slightly moist.

3-10' Orange-brown gravelly SAND, fine to coarse, trace to little black sand, poorly sorted, slightly moist.

10-10.7' Orange-brown SAND, fine to coarse, trace to little black sand, fine, somewhat dense, moist.

10.7-11' Light tan to orange-brown gravelly SAND, fine to coarse, clay layer at 10.9' BGS, some silt, slightly moist.

11-18.4' Light orange-brown SAND, fine to coarse, little to some silt, somewhat loose, uniform throughout interval, slightly moist.

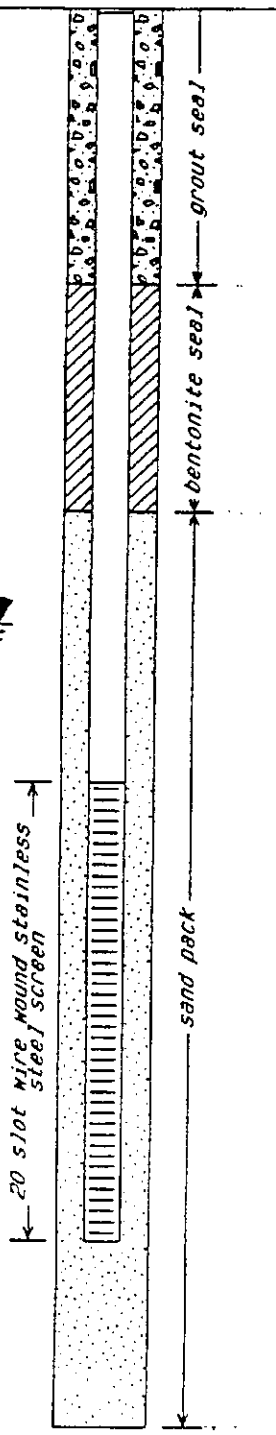
18.4-23' Light tannish brown SAND, fine to medium grained, little black sand, fine, well sorted, slightly moist.

23-34' Light brown SAND, fine to medium grained, little orange sand layers through interval, trace silt, loose.

# MONITOR WELL

PROJECT STANDARD CHLORINE WELL NUMBER MW-08

| DEPTH IN FEET | WELL CONSTRUCTION DETAIL | SAMPLE INTERVAL | BLOW COUNT | % RECOVERY | GRAPHIC SYMBOL | HNU/OVA READING | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| 24 | | X | 7 7 | 65 | | BKG/ BKG-1.5 | increasing moisture content through interval. |
| 26 | | | | | | | |
| 28 | | X | 7 9 8 9 | 70 | | BKD/1 | |
| 30 | | | | | | | |
| 32 | | | | | | | |
| 34 | | X | 7 7 9 9 | 88 | | BKD/1 | 34-38.9' Light orange-brown SAND, fine to coarse grained, trace silt, moderately sorted, wet at 36.5'BGS, odor. |
| 36 | | | | | | | |
| 38 | | X | 4 4 5 9 | 85 | | 1/10 | 38.9-45.5' Light brown to orange-brown SAND, fine to coarse grained, trace silt and gravel, moderate to poorly sorted, wet. |
| 40 | | | | | | | |
| 42 | | | | | | | |
| 44 | | X | 10 9 12 12 | 78 | | D-1/6 | |
| 46 | | X | 7 10 11 9 | 63 | | D-1/6 | 45.5-45.9' Orange-brown to brown SAND, fine to medium grained, some silt, somewhat dense, wet. |
| 48 | | X | 7 7 13 15 | 78 | | 1/10 | 45.9-47.3' Light brown SAND, fine to coarse grained, trace silt, poorly sorted, wet. |
| 50 | | X | 12 6 6 7 | 65 | | D/12 | 47.3-50.3' Medium brown SAND, fine to medium grained, trace to little silt, trace pebbles, poorly sorted, loose, wet. |
| 52 | | X | 7 11 12 11 | 20 | | -/9 | 50.3-55' Gray CLAY, some (25%) sand, trace orange-brown clay (thin layer ~0.1'), somewhat dense, plastic, slightly moist (MERCHANTVILLE). |
| 54 | | X | 8 9 11 11 | 43 | | -/8 | |
| 56 | | | | | | | |

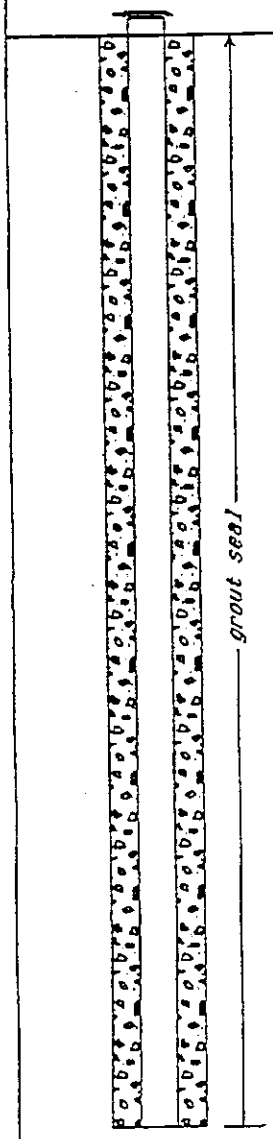


# MONITOR WELL



Project STANDARD CHLORINE
Location DELAWARE CITY, DE.
Geologist D. Cairns
Drilling Contractor JCA
Driller Joe Jester
Drilling Method Hollow stem auger
Diameter of Borehole 12 inches
Diameter of Well Casing 4 inches

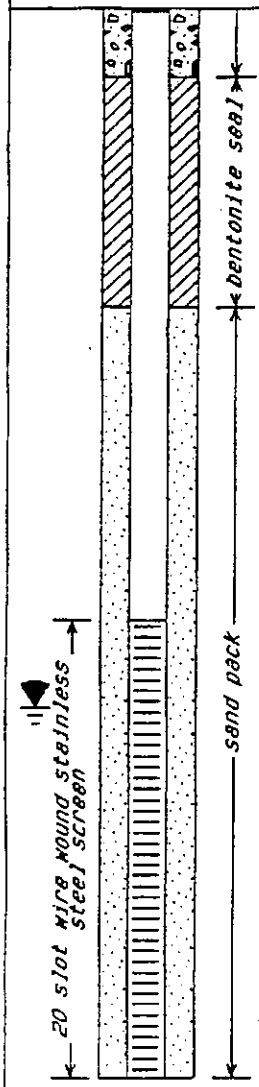
Well Number MW-09
Coordinates 583278.01 N; 437833.34 E
Top of Casing Elevation 47.45 feet
Groundsurface Elevation 45.00 feet
Total Borehole Depth 50 feet
Total Well Depth 47.42 feet
Date Started 1/11/90
Date Well Completed 1/15/90

| DEPTH IN FEET | WELL CONSTRUCTION DETAIL | SAMPLE INTERVAL | BLOW COUNT | % RECOVERY | GRAPHIC SYMBOL | HNU/OVA READING | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| 0 |  | X | 1 3 3 3 | 55 | | BKG/2 | 0-0.3' Light to medium brown sandy LOAM, some organics - leaves, roots, sand is fine to medium grained, well sorted, somewhat loose, slightly moist. |
| 2 | | | | | | | 0.3-5' Dark brown to black clayey SILT, rich in organics, somewhat plastic, moist. |
| 4 | | | | | | | |
| 5 | | X | 1 3 3 2 | 60 | | BKG/60 | 5-10' Medium gray silty CLAY, some decomposing wood fragments, slightly plastic, soft, moist. |
| 8 | | | | | | | |
| 10 | | X | 12 9 9 12 | 0 | | -/- | 10-15' Gray CLAY, very poor recovery. |
| 12 | | | | | | | |
| 14 | | | | | | | |
| 15 | | X | 12 9 11 13 | 30 | | BKG/1 | 15-20' Orange SAND, fine to coarse grained, trace very coarse sand, trace black medium grained sand, poorly sorted, somewhat loose, dry. |
| 18 | | | | | | | |
| 20 | | X | 6 6 6 6 | 65 | | BKG/BKG | 20-25' Light brown SAND, fine to medium grained, trace medium grained black sand, well sorted, loose, dry. |
| 22 | | | | | | | |
| 24 | | | | | | | |

grout seal

# MONITOR WELL

PROJECT STANDARD CHLORINE WELL NUMBER MW-09




| DEPTH IN FEET | SAMPLE INTERVAL | BLOW COUNT | % RECOVERY | GRAPHIC SYMBOL | HNU/OVA READING | DESCRIPTION |
|---|---|---|---|---|---|---|
| 24 | | | | | | |
| 26 | X | 6 7 6 7 | 95 | | BKG/BKG | 25-35' Light gray-white SAND, fine to medium grained, with some lenses of orange-brown and black SAND, well sorted, somewhat dense, dry to slightly moist. |
| 28 | | | | | | |
| 30 | X | 8 9 10 10 | 95 | | BKG/BKG | |
| 32 | | | | | | |
| 34 | | | | | | |
| 36 | X | 6 7 8 9 | 100 | | BKG/1 | 35-40' Medium orange-brown SAND, fine to medium grained, trace black sand, fine, well sorted, wet at 36.5'BGS. |
| 38 | | | | | | |
| 40 | X | 5 5 5 12 | 85 | | 5/2 | 40-45' Dark orange-brown SAND, fine to medium grained, some fine to very coarse sand from 40.2-40.8'BGS, poorly sorted, trace pebbles, somewhat loose, saturated. |
| 42 | | | | | | |
| 44 | | | | | | |
| 46 | X | 11 20 22 15 | 90 | | 1/7 | 45-47' Light gray to orange-brown SAND, fine to coarse, some coarse to very coarse sand, trace black sand, fine, somewhat loose, saturated. |
| 48 | X | 10 10 12 14 | 70 | | BKG/BKG | 47-49' Dark gray CLAY, some very fine sand and silt, slightly plastic, slightly moist to dry, (MERCHANTVILLE). |
| 50 | X | 12 12 | 100 | | BKG/BKG | 49-50' Dark gray sandy CLAY, little (>10%) silt, sand very fine to fine, angular, dense, plastic, slightly moist. |
| 52 | | | | | | |
| 54 | | | | | | |
| 56 | | | | | | |



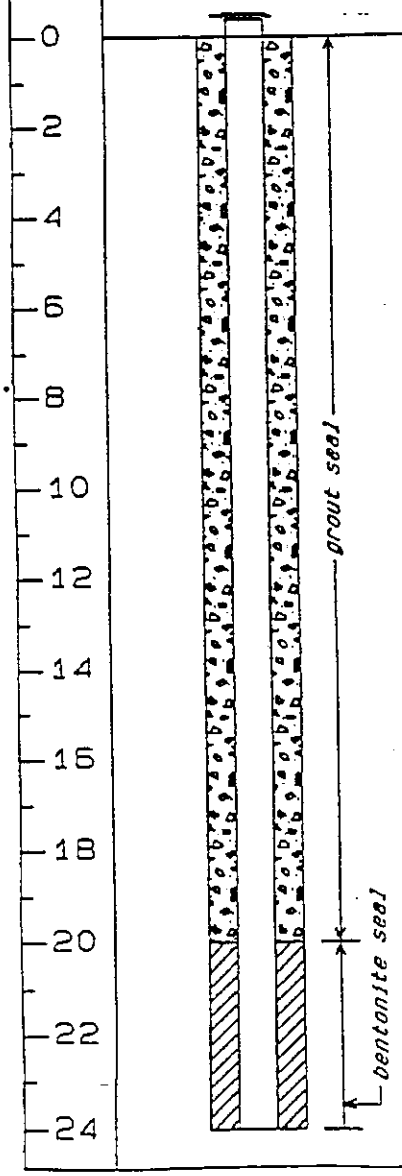
AR306614

# MONITOR WELL



Project: STANDARD CHLORINE
Location: DELAWARE CITY, DE.
Geologist: D. Cairns
Drilling Contractor: JCA
Driller: Joe Jester
Drilling Method: Hollow stem auger
Diameter of Borehole: 12 inches
Diameter of Well Casing: 4 inches

Well Number: MW-10
Coordinates: 583087.86 N; 437676.65 E
Top of Casing Elevation: 48.16 feet
Groundsurface Elevation: 46.23 feet
Total Borehole Depth: 43 feet
Total Well Depth: 42.5 feet
Date Started: 6/26/90
Date Well Completed: 6/26/90




| Sample interval | Blow count | Recovery | Graphic symbol | HNU/OVA reading | Description |
|---|---|---|---|---|---|
| X | 9 13 16 16 15 | 10 | | -/BKG | 10-13' Red-brown SILTY SAND and clay, soft, moist. |
| | | | | | 13-15' GRAVEL layer, dry. |
| X | 5 5 7 8 | 100 | | -/BKG | 15-17' Light brown to orange SAND, medium to coarse grained, some gravel (10%) up to 1" in diameter, loose, dry to slightly moist. |
| X | 5 5 4 1 | 80 | | -/BKG | 20-22' Light brown to orange SAND, medium to coarse grained, gravel (5%) up to 0.5" in diameter quartz, subrounded, some lignite, loose, moist. |

AR306615

# MONITOR WELL

PROJECT STANDARD CHLORINE WELL NUMBER MW-10

| DEPTH IN FEET | WELL CONSTRUCTION DETAIL | SAMPLE INTERVAL | BLOW COUNT | % RECOVERY | GRAPHIC SYMBOL | HNU/OVA HEADSPACE | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| 24 | | | | | | | |
| 26 | | X | 3 3 3 2 | 80 | | -/BKG | 25-27' Light brown to orange SAND, same as above, uniform grade, some lignite, moist. |
| 28 | | | | | | | |
| 30 | | X | 3 3 3 3 | 90 | | -/BKG | |
| 32 | | | | | | | |
| 34 | | | | | | | |
| 36 | | X | 4 5 5 5 | 90 | | 0/10-16 | 35-36' Same as above. 36-37' Light brown to orange SAND, medium to coarse grained, loose, wet. |
| 38 | | | | | | | |
| 40 | | X | 7 8 10 10 | 100 | | -/BKG | 40-41.7' Light brown to orange SAND, coarse to medium grained, loose, saturated. |
| 42 | | X | 7 8 | 100 | | -/BKG | 41.7-42' Dark gray CLAY, very stiff, silty clay, moist (MERCHANTVILLE). 42-43' Dark gray silty CLAY, very stiff, plastic, moist (MERCHANTVILLE). |
| 44 | | | | | | | |
| 46 | | | | | | | |
| 48 | | | | | | | |
| 50 | | | | | | | |
| 52 | | | | | | | |
| 54 | | | | | | | |
| 56 | | | | | | | |

20 slot wire wound stainless steel screen

sand pack

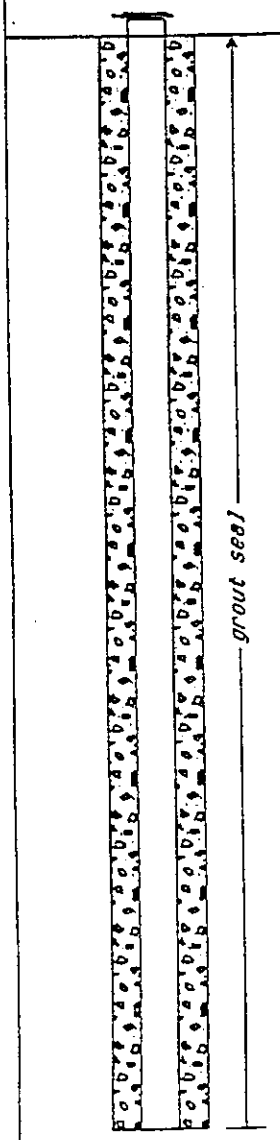


AR306616

# MONITOR WELL

Project STANDARD CHLORINE
Location DELAWARE CITY, DE.
Geologist D. Cairns, L. Lawlor
Drilling Contractor JCA
Driller Joe Jester
Drilling Method Mud Rotary
Diameter of Borehole 7 7/8 inches
Diameter of Well Casing 4 inches

Well Number MW-11
Coordinates 581855.33 N 438139.64 E
Top of Casing Elevation 53.48 feet
Groundsurface Elevation 51.97 feet
Total Borehole Depth 148 feet
Total Well Depth 135 feet
Date Started 2/12/90
Date Well Completed 2/24/90

| DEPTH IN FEET | WELL CONSTRUCTION DETAIL | SAMPLE INTERVAL | BLOW COUNT | % RECOVERY | GRAPHIC SYMBOL | HNU/OVA READING | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| 0 |  | | | | | | 0-2' limestone GRAVEL, area has been excavated and filled in (depth based on bit). |
| 2 | | | | | | | 2-10' Orange-brown SAND, fine to coarse grained some (20%) silt, little pebbles, gravel layer at 5.0' BGS, poorly sorted, moist. |
| 4 | | X | 6 10 9 12 | 42 | | -/BKG | |
| 6 | | | | | | | |
| 8 | | | | | | | |
| 10 | | X | 7 11 9 13 | 27 | | -/BKG | 10-15' Light brown SAND and GRAVEL, little silt sand, fine to coarse, poor recovery due to driving a piece of gravel, moist. |
| 12 | | | | | | | |
| 14 | | X | 7 12 11 10 | 20 | | -/BKG | 15-25' Light tannish brown SAND, fine to medium grained, some coarse sand with pebbles in top of interval, little silt, poorly sorted, moist. |
| 15 | | | | | | | |
| 18 | | | | | | | |
| 20 | | X | 9 12 11 11 | 57 | | -/BKG | |
| 22 | | | | | | | |
| 24 | | | | | | | |

# MONITOR WELL

PROJECT STANDARD CHLORINE WELL NUMBER MW-11

| DEPTH IN FEET | WELL CONSTRUCTION DETAIL | SAMPLE INTERVAL | BLOW COUNT | RECOVERY | GRAPHIC SYMBOL | UNIV/OVA READING | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| 24 | grout seal | X | 8 10 10 12 | 20 | | -/BKG | 25-35' Light brown to light tannish brown SAND, fine to coarse, little (10%) silt, poorly sorted, somewhat loose, less percentage of coarse through interval, poor to moderate sorting, moist. |
| 26 | | | | | | | |
| 28 | | | | | | | |
| 30 | | X | 12 15 13 12 | 32 | | -/BKG | |
| 32 | | | | | | | |
| 34 | | X | 12 11 9 10 | 25 | | -/BKG | 35-40' Brown SAND, fine to medium grained, trace coarse, moderately sorted, somewhat loose, moist. |
| 36 | | | | | | | |
| 38 | | | | | | | GRAVEL layer at 37'BGS - based on bit performance. |
| 40 | | X | 17 17 17 17 | 5 | | -/BKG | 40-45' very poor recovery - orange-brown SAND, fine to medium grained, some silt, little coarse sand - probably pushed gravel, moist. |
| 42 | | | | | | | |
| 44 | | | | | | | |
| 46 | | X | 14 12 12 7 | 40 | | BKG/- | 45-52' Brown SAND, fine to medium grained, little silt, little to trace very fine sand, trace pebbles, moderately sorted, wet. |
| 48 | | | | | | | WATER between 42-45' BGS. |
| 50 | | X | 15 15 14 17 | 0 | | -/- | |
| 52 | | X | 13 10 9 9 | 65 | | -/.5-1 | 52-63' Orange-brown SAND, fine to medium, with some light tannish-brown SAND, fine to medium grained, some silt, little to some coarse sand and pebbles (increasing percentage through interval), trace mica, poorly sorted, wet. |
| 54 | | X | 11 8 9 8 | 25 | | -/.5-1 | |
| 56 | | | | | | | |



AR306618

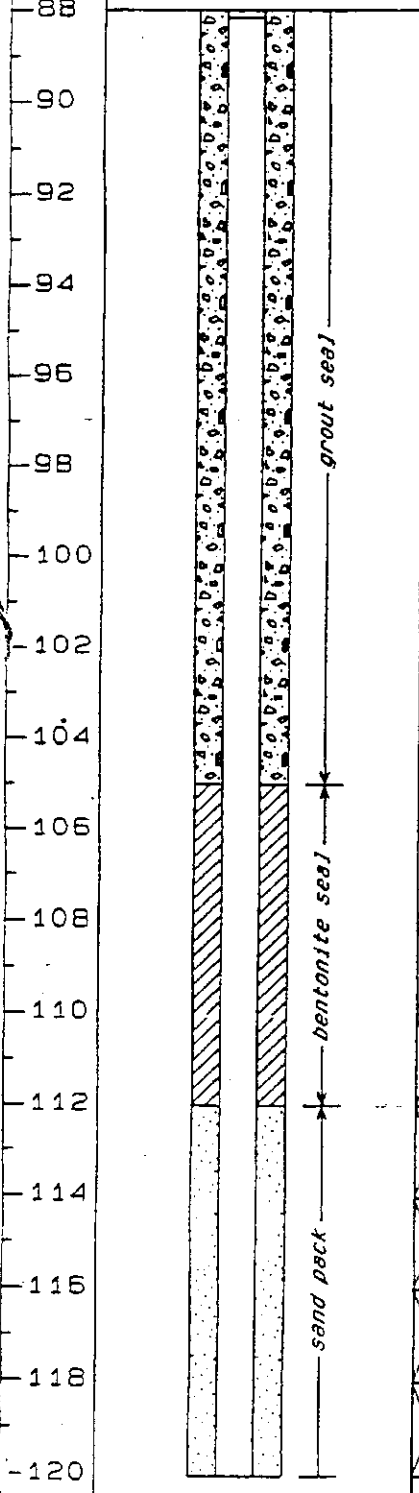
# MONITOR WELL

PROJECT STANDARD CHLORINE WELL NUMBER MW-11

| DEPTH IN FEET | WELL CONSTRUCTION DETAIL | SAMPLE INTERVAL | BLOW COUNT | % RECOVERY | GRAPHIC SYMBOL | HNU/OVA READING | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| 56 | | | | | | | |
| 58 | | | | | | | |
| 60 | | X | 13 12 15 13 14 | 37 | | -/1 | |
| 62 | | | | | | | 63-64' GRAVEL layer - based on bit performance, also some orange clay in matrix. |
| 64 | | X | 8 8 9 9 10 | 90 | | -/1 | 64-74' Dark gray to gray CLAY, some silt and fine sand (25% each), sand micaceous- very fine to fine, plastic, firm, moist (MERCHANTVILLE fm.). |
| 66 | | X | 0 8 8 10 | 0 | | -/- | |
| 68 | | X | 6 8 12 12 | 95 | | -/1 | |
| 70 | | X | 8 10 14 14 | 100 | | -/BKG | |
| 72 | grout seal | X | 10 12 16 20 | 85 | | -/BKG | |
| 74 | | X | 14 23 32 52 | 70 | | BKG/BKG | 74-74.3' Dark gray to black CLAY, trace sand, very fine grained, high plasticity, soft, moist. |
| 76 | | | | | | | 74.3-78' Light gray SAND, very fine to fine grained, and CLAY, little silt, sand and clay alternating layers, clay - dense, plastic, slightly moist to moist. |
| 78 | | X | 110 50/.3 | 60 | | BKG/BKG | 78-82.75' Gray silty SAND, fine grained, uniform, dry. |
| 80 | | X | 55 87 100/.5 | 40 | | BKG/BKG | |
| 82 | | X | 20 28 41 48 | 50 | | BKG/BKG | 82.75-84' Black SAND, fine to medium grained, no fines; moist. |
| 84 | | X | 8 7 13 24 | 90 | | BKG/BKG | 84-86.7' Light gray CLAY to SILTY CLAY, stiff, high plasticity, moist. |
| 86 | | X | 14 83 4 3 | 85 | | BKG/BKG | 86.7-88.6' Light gray to black SAND, fine to medium grained, well sorted, moist. |
| 88 | | | | | | | |

# MONITOR WELL

PROJECT STANDARD CHLORINE WELL NUMBER MW-11



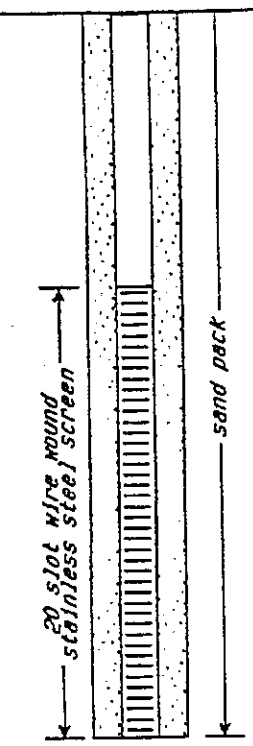

| SAMPLE INTERVAL | BLOW COUNT | % RECOVERY | GRAPHIC SYMBOL | HNU/OVA HEADSPACE | DESCRIPTION |
|---|---|---|---|---|---|
| | 8 5 9 12 | 80 | | BKG/BKG | 88.6-89.1' Gray CLAY, stiff, plastic, moist. 89.1-90.7' Gray and red mottled CLAY, stiff, low plasticity, dry. |
| | 12 16 28 33 | 85 | | BKG/BKG | 90.7-95.7' Light gray to gray CLAY to SILTY CLAY, stiff, slightly plastic to non-plastic, trace red mottled in bottom 0.7', slightly moist to dry. |
| | 7 12 16 24 | 100 | | BKG/BKG | |
| | 9 11 16 24 | 100 | | BKG/BKG | |
| | 12 16 18 25 | 70 | | BKG/BKG | 95.7-98.25' Gray silty SAND and gray silty CLAY sand very fine to fine grained, clay- stiff, plasic, moist. |
| | 12 19 21 26 | 90 | | BKG/BKG | 98.25-98.75' Light gray SAND, fine to medium grained, loose, wet. 98.75-101.75' Gray CLAY, some red bands, dense, plastic, moist. |
| | 10 14 22 25 | 100 | | BKG/BKG | |
| | 10 14 17 19 | 100 | | BKG/BKG | 101.75-102' Light gray SAND, fine to medium grained, same as 98.25-98.75'. 102-108.2' Gray CLAY to gray SILTY CLAY, trace bands of sand (wet), clay - dense, stiff, plastic, moist. |
| | 10 15 18 28 | 100 | | BKG/BKG | |
| | 18 19 27 45 | 90 | | BKG/BKG | |
| | 15 16 17 18 | 100 | | BKG/BKG | 108.2-108.7' Light gray SAND, fine to medium grained, well sorted, loose, wet. 108.7-110' Light gray SILT and CLAY, some sand, fine grained, stiff, plastic, moist. |
| | 10 11 19 26 | 100 | | BKG/BKG | 110-110.4' Gray SAND and CLAY, dense, plastic, moist. |
| | 30 39 49 51 | 60 | | BKG/BKG | 110.4-110.8' Light gray SAND, fine grained, loose, well sorted, wet. 110.8-112.4' SAND and CLAY, same as 110-110.4'. |
| | 24 16 25 67 | 100 | | BKG/BKG | 112.4-115.5' Light gray SAND to SILTY SAND, fine grained, well sorted, firm, moist. |
| | 53 67 67 82 | 50 | | BKG/BKG | 115.5-116' Light gray to red SILT and SAND, some gravel, poorly sorted, loose, moist. |
| | 17 30 64 92 | 20 | | BKG/BKG | 116-117' Light gray SAND, fine grained, some red-orange bands, stiff, wet. 117-130' Brown to brownish-white (buff) to red SAND, fine grained, some medium sand, little silt, dense-stiff, moist. |

# MONITOR WELL



PROJECT STANDARD CHLORINE WELL NUMBER MW-11

| DEPTH IN FEET | WELL CONSTRUCTION DETAIL | SAMPLE INTERVAL | BLOW COUNT | % RECOVERY | GRAPHIC SYMBOL | MPV/OVA READING | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| 120 | | | 47 67 67 75 | 0 | | BKG/BKG | |
| 122 | | | 41 100/.4 | 45 | | BKG/BKG | |
| 124 | | | 70 100/.25 | 50 | | BKG/BKG | |
| 126 | | | 98 100/.4 | 0 | | BKG/BKG | |
| 128 | | | 82 126 150 | 60 | | BKG/BKG | |
| 130 | | | 45 41 31 32 | 0 | | BKG/BKG | 130-133' Red and white CLAY, some silt, high plasticity, stiff, moist. |
| 132 | | | 23 86 100/.3 | 85 | | BKG/BKG | 133-136' Buff brown SAND, fine grained, well sorted, loose, wet. |
| 134 | | | 158/.5 | 25 | | BKG/BKG | |
| 136 | | | 200/.4 | 20 | | BKG/BKG | 136-140.4' Light gray and red mottled CLAY, very stiff, low plasticity, dry |
| 138 | | | 38 45 65 80 | 65 | | BKG/BKG | |
| 140 | | | 28 40 45 60 | 100 | | BKG/BKG | 140.4-148' Red, green and brown mottled CLAY with some SILTY CLAY, very stiff, plastic, moist. |
| 142 | | | 27 44 59 73 | 100 | | BKG/BKG | |
| 144 | | | 21 31 42 47 | 100 | | BKG/BKG | |
| 146 | | | 21 34 31 44 | 100 | | BKG/BKG | |
| 148 | | | | | | | END OF BORING - 148' BGS. |
| 150 | | | | | | | |
| 152 | | | | | | | |






AR306621

# MONITOR WELL

| | | | |
|---|---|---|---|
| Project | STANDARD CHLORINE | Well Number | MW-12 |
| Location | DELAWARE CITY, DE. | Coordinates | 583095.19 N; 439558.09 E |
| Geologist | L. Lawlor | Top of Casing Elevation | 55.78 feet |
| Drilling Contractor | JCA | Groundsurface Elevation | 53.71 feet |
| Driller | Joe Jester | Total Borehole Depth | 148 feet |
| Drilling Method | Mud Rotary | Total Well Depth | 140 feet |
| Diameter of Borehole | 7 7/8 inches | Date Started | 6/12/90 |
| Diameter of Well Casing | 4 inches | Date Well Completed | 6/20/90 |

| DEPTH IN FEET | WELL CONSTRUCTION DETAIL | SAMPLE INTERVAL | BLOW COUNT | % RECOVERY | GRAPHIC SYMBOL | HNU/OVA READING | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| 0 | | | | | | | |
| 2 | | | | | | | |
| 4 | | | | | | | |
| 6 | | X | 15 23 16 17 | 25 | | BKG/30 | 5-7' Orange SAND with 20% GRAVEL (up to 0.5" in diameter), coarse to medium grained sand, subrounded gravel, loose, moist. |
| 8 | | | | | | | |
| 10 | | X | 13 10 7 7 | 0 | | -/- | 10-12' No recovery. |
| 12 | | | | | | | |
| 14 | | | | | | | |
| 16 | | X | 13 10 13 10 | 5 | | BKG/BKG | 15-17' Light brown, SAND and GRAVEL ( up to 1" in diameter), sand- medium to fine grained, subrounded gravel, moist. |
| 18 | | X | - | 50 | | BKG/BKG | |
| 20 | | X | 10 10 12 10 | 50 | | BKG/BKG | 20-22' Same as above. |
| 22 | | | | | | | |
| 24 | | | | | | | |

grout seal

# MONITOR WELL

PROJECT STANDARD CHLORINE WELL NUMBER MW-12

| DEPTH IN FEET | WELL CONSTRUCTION DETAIL | SAMPLE INTERVAL | BLOW COUNT | % RECOVERY | GRAPHIC SYMBOL | HNU/OVA HEADSPACE | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| 24 | | | | | | | |
| 26 | grout seal | X | 8 9 10 10 | 60 | | BKG/BKG | 25-27' Light brown SAND and some SILT, medium to fine grained, stiff, uniform grading, some specs of lignite, moist. |
| 28 | | | | | | | |
| 30 | | X | 14 12 11 15 | 50 | | BKG/BKG | |
| 32 | | | | | | | |
| 34 | | | | | | | |
| 36 | | X | 12 12 12 14 | 70 | | BKG/BKG | 35-37' Light brown to buff SAND and some SILT, coarse to fine grained, dry. |
| 38 | | | | | | | |
| 40 | | X | 20 16 17 18 | 0 | | BKG/BKG | 40-42' No recovery. |
| 42 | | | | | | | |
| 44 | | | | | | | |
| 46 | | X | - | 0 | | -/- | 45-47' No recovery. |
| 48 | | X | 25 40 35 20 | 50 | | BKG/BKG | 47-49' Light brown-orange SAND and some GRAVEL, medium to coarse grained, loose, wet. |
| 50 | | | | | | | |
| 52 | | | | | | | |
| 54 | | | | | | | |
| 56 | | X | 30 32 | 80 | | BKG/BKG | 55-57' Light brown-orange SAND, stiff, medium to coarse grained, moist. |



AR306623

# MONITOR WELL

PROJECT STANDARD CHLORINE WELL NUMBER MW-12

| DEPTH IN FEET | WELL CONSTRUCTION DETAIL | SAMPLE INTERVAL | BLOW COUNT | % RECOVERY | GRAPHIC SYMBOL | HNU/OVA READING | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| 56 | | X | 20 25 | 80 | | BKG/BKG | |
| 58 | | | | | | | |
| 60 | | X | 15 19 21 24 | 90 | | BKG/BKG | 60-62' Light brown SAND, medium to coarse grained, stiff, some lignite, moist. |
| 62 | | X | 20 23 30 34 | 35 | | BKG/BKG | 62-64' Light brown SAND, medium grained, uniform, stiff, moist. |
| 64 | | X | 25 21 21 20 | 50 | | BKG/BKG | 64-66' Reddish (oxidized) brown SAND, medium to coarse grained, stiff, moist. |
| 66 | | X | 19 15 13 23 | 50 | | BKG/BKG | 66-68' Same as above. |
| 68 | | X | 20 35 30 15 | 30 | | BKG/BKG | 68-70' Red-orange SAND, medium to coarse grained, stiff, moist. |
| 70 | grout seal | X | 18 27 13 9 | 5 | | BKG/BKG | 70-72' Dark gray CLAY (MERCHANTVILLE fm), plastic, moist, 2" of pushed rock at the end of spoon. |
| 72 | | | | | | | |
| 74 | | X | 7 10 12 13 | 40 | | BKG/BKG | 74-76' Dark gray CLAY, poorly graded with some silt and sand, dense, stiff, moist (MERCHANTVILLE fm). |
| 76 | | X | 7 9 10 10 | 30 | | BKG/BKG | 76-77' Dark gray CLAY, (MERCHANTVILLE fm). 77-78' Red and gray CLAY, very stiff, dense, moist (POTOMAC fm). |
| 78 | | X | 8 10 13 9 | 45 | | BKG/BKG | 78-80' Red and light gray CLAY, very stiff, dense, plastic, moist (POTOMAC fm). |
| 80 | | X | 12 16 33 38 | 100 | | BKG/BKG | 80-82' Red and gray mottled CLAY, very stiff, dense, plastic, moist (POTOMAC fm). |
| 82 | | X | 15 16 23 29 | 65 | | BKG/BKG | 82-84' Same as above (POTOMAC fm). |
| 84 | | X | 40 45 55 63 | 100 | | BKG/BKG | 84-86' Same as above (POTOMAC fm). |
| 86 | | | | | | | 87-90' Light brown and reddish SAND, medium to coarse grained, loose, wet. |
| 88 | | | | | | | |

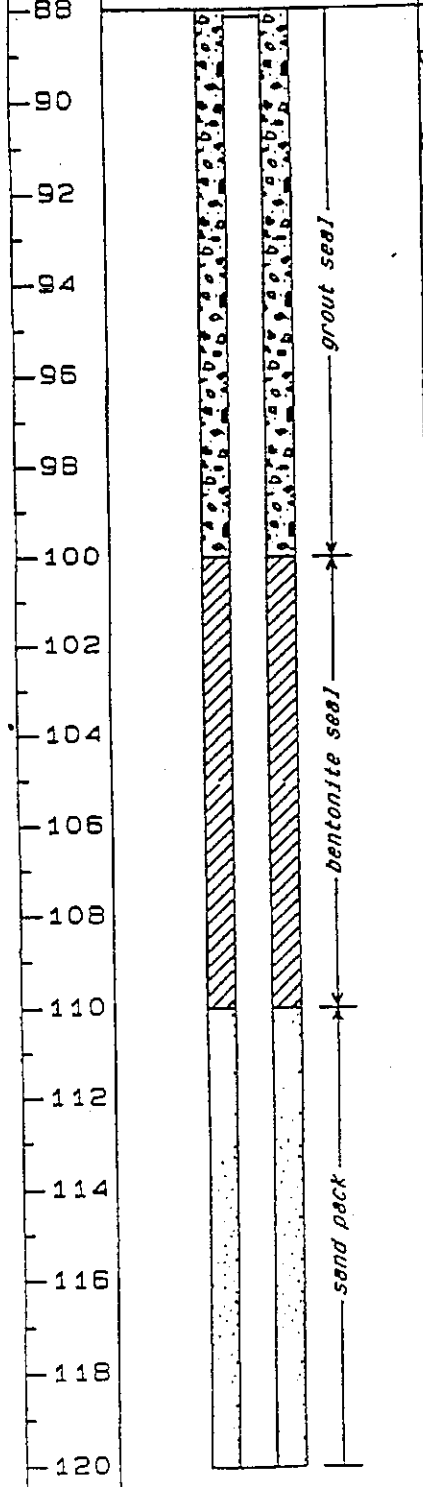


AR306624

# MONITOR WELL



PROJECT STANDARD CHLORINE WELL NUMBER MW-12

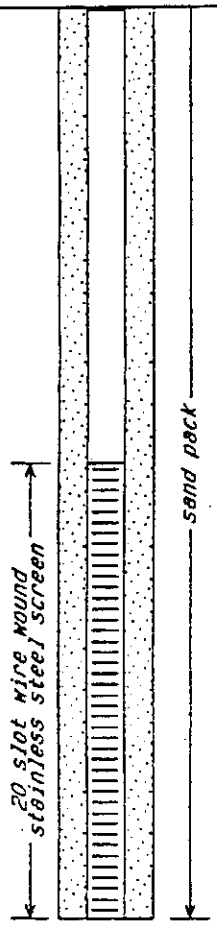



| SAMPLE INTERVAL | BLOW COUNT | % RECOVERY | GRAPHIC SYMBOL | MOV/OVA READING | DESCRIPTION |
|---|---|---|---|---|---|
| | 12 30 41 40 | 100 | | BKG/BKG | 90-91' Light gray and red CLAY, stiff, with 1" seam of 0.25" rounded GRAVEL, moist (POTOMAC fm). |
| | 13 24 | 50 | | BKG/BKG | 91-92' Red CLAY, stiff, dense, plastic, moist. |
| | 21 40 100/.5 | 70 | | BKG/BKG | 92-93' Gray and red CLAY, dense, stiff, moist. |
| | 41 89 100/.5 | 45 | | BKG/BKG | 93-94' Light gray SILTY SAND, fine grained, moist. |
| | 33 50 50 54 | 60 | | BKG/BKG | 94-96' Light gray SILTY SAND, very fine sand, stiff, uniform grade, moist. |
| | 15 33 31 25 | 100 | | BKG/BKG | 96-98' Light gray SILTY SAND, very fine grained, uniform grade, weak cementation, moist. |
| | 22 35 30 32 | 10 | | BKG/BKG | 98-100' Light brown, gray and red silty SAND, very fine grained, lenses of fine sand, weak cementation, moist to wet. |
| | 30 21 28 30 | 100 | | BKG/BKG | 100-102' Dark to medium gray CLAY, stiff, with some silt, moist. |
| | 7 15 18 18 21 | 100 | | BKG/BKG | 102-104' Light gray CLAY and fine SAND, lenses of silty clay, stiff, dry, up to 0.25" thick, fine sand and silt between clay lenses, moist to wet. |
| | 13 20 35 70 | 100 | | BKG/BKG | 104-106' Dark gray and reddish SILTY CLAY, very stiff, low plasticity, dry to moist. |
| | 20 55 86 85 | 80 | | BKG/BKG | 106-108' Dark and light gray SILTY CLAY, very stiff, plastic, 2" lenses of fine sand, moist. |
| | 15 45 44 45 | 100 | | BKG/BKG | 108-110' Light gray SILTY SAND, fine grained sand, loose to stiff, uniform grade, moist. |
| | 14 45 54 80 | 100 | | BKG/BKG | 110-112' Medium gray SILTY CLAY, stiff, with 3" lenses of light gray SAND, uniform, loose, dry to wet. |
| | 18 54 100/.5 | 50 | | BKG/BKG | 112-114' Gray to dark gray SILTY SAND and CLAY, interbedded fine silty sand and silty clay, firm, clay- moist, sand - moist to wet. |
| | 28 55 55 45 | 100 | | BKG/BKG | 114-116' Same as above. |
| | 25 40 80 72 | 100 | | BKG/BKG | 116-118' Light gray silty SAND and CLAY, fine grained, loose, uniform grade, with two lenses of dark gray clay approximately 3" long, very stiff, dense, moist. |
| | | | | | 118-120' Gray silty CLAY, very stiff, dense, low plasticity, one 2" lense of moist fine grained sand, light gray. |

# MONITOR WELL

PROJECT STANDARD CHLORINE WELL NUMBER MW-12

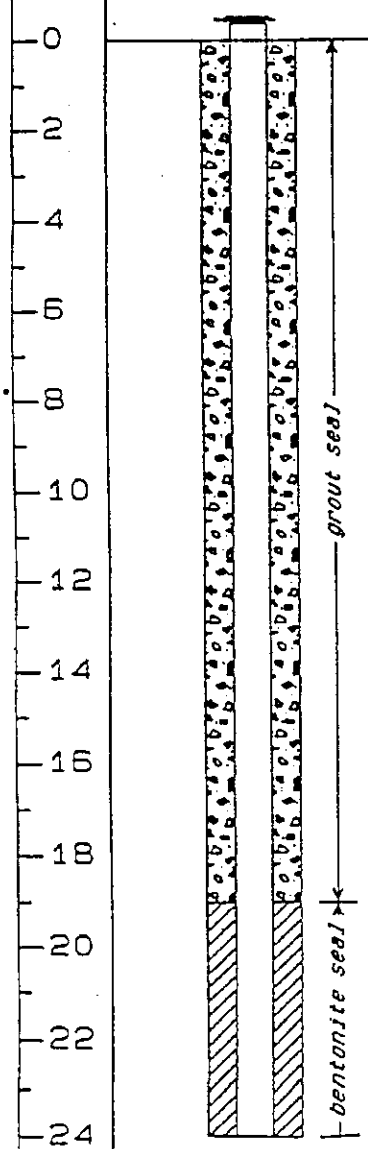
| DEPTH IN FEET | WELL CONSTRUCTION DETAIL | SAMPLE INTERVAL | BLOW COUNT | % RECOVERY | GRAPHIC SYMBOL | PPM/OVA READING | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| 120 | | | 21 54 100/.3 | 60 | | -/BKG | loose, lower 2" oxidized fine silty sand, deep red color, stiff, moist. |
| 122 | | | 70 100/.3 | 35 | | -/BKG | 120-122' Very light gray to white silty SAND, fine grained sand, firm, moist, with 3" lense of light gray CLAY, stiff, moist. |
| 124 | | | 38 100/.2 | 30 | | -/- | 122-124' Red (oxidized) silty SAND, poorly graded, fine to coarse grained sand, loose, some gravel, 2" lense of light gray clay at top and bottom of spoon, moist, 2" lense of medium sand and gravel at bottom of spoon, above 1" clay layer, wet. |
| 126 | | | 100/.6 | 15 | | -/BKG | |
| 128 | | | 100/.6 | 20 | | -/BKG | 124-126' Light brown, reddish and white silty SAND, firm, fine grained sand, uniform grade, moist. |
| 130 | | | 150/.5 | 0 | | -/- | 126-128' Light brown and white silty SAND and CLAY, firm, moist. 128-130' White silty SAND, uniform grade, fine grained sand, firm, dense, moist. |
| 132 | | | 200/.6 | 0 | | -/- | 130-132' No recovery. |
| 134 | | | 45 35 75 100/.2 | 100 | | -/BKG | 132-134' No recovery. 134-135' Light gray silty CLAY, dense, very stiff, moist. |
| 136 | | | 85 100/.2 | 35 | | -/BKG | 135-136' Light gray silty SAND, firm, moist. 136-137' Red stained silty CLAY, very stiff, moist. |
| 138 | | | 30 70 53 50 60 | 25 | | -/BKG | WATER zone at 137-138' BGS. 137-138' Light gray to white silty SAND, firm, uniform grade, moist. |
| 140 | | | 15 39 40 49 | 65 | | -/BKG | 138-140' Red (oxidized) silty CLAY with GRAVEL, dense, moist. |
| 142 | | | 40 60 82 85 | 60 | | -/BKG | 140-142' Red and light gray, mottled, CLAY, very stiff, dense, low plasticity, dry (POTOMAC fm). |
| 144 | | | 35 68 78 62 | 55 | | -/BKG | 142-144' Same as above. 144-146' Light gray and red, mottled, CLAY, very dense, stiff, uniform grading, moist. |
| 146 | | | 30 40 68 72 | 80 | | -/BKG | 146-148' Light gray CLAY, very stiff, dense, low plasticity, dry. |
| 148 | | | | | | | END OF BORING - 148' BGS. |
| 150 | | | | | | | |
| 152 | | | | | | | |



# MONITOR WELL

Project STANDARD CHLORINE
Location DELAWARE CITY, DE.
Geologist L. Lawlor
Drilling Contractor JCA
Driller Joe Jester
Drilling Method Hollow stem auger
Diameter of Borehole 12 inches
Diameter of Well Casing 4 inches

Well Number MW-13
Coordinates 582565.29 N; 437432.48 E
Top of Casing Elevation 48.44 feet
Groundsurface Elevation 46.39 feet
Total Borehole Depth 47 feet
Total Well Depth 44 feet
Date Started 6/25/90
Date Well Completed 6/25/90




| DEPTH IN FEET | SAMPLE INTERVAL | BLOW COUNT | % RECOVERY | GRAPHIC SYMBOL | HNU/OVA READING | DESCRIPTION |
|---|---|---|---|---|---|---|
| 0 | | | | | | |
| 2 | | | | | | |
| 4 | | | | | | |
| 6 | | | | | | |
| 8 | | | | | | |
| 10 | | | | | | |
| 12 | | | | | | |
| 14 | | | | | | |
| 15 | X | 5 5 7 9 | 100 | | -/26 | 15-17' Brown-orange SAND, medium to coarse grained, well graded, moist. |
| 18 | | | | | | |
| 20 | X | 4 7 7 7 | 100 | | /BKG-10 | 20-22' Light brown to buff SAND, medium to coarse grained, uniform grade, some orange coarse gravel at top 3", dry to slightly moist. |
| 22 | | | | | | |
| 24 | | | | | | |

# MONITOR WELL

PROJECT STANDARD CHLORINE WELL NUMBER MW-13

| DEPTH IN FEET | WELL CONSTRUCTION DETAIL | SAMPLE INTERVAL | BLOW COUNT | RECOVERY | GRAPHIC SYMBOL | HNU/OVA READING | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| 24 | | | | | | | |
| 26 | | X | 6 7 9 9 | 100 | | -/BKG | 25-27' Light brown-orange SAND, medium to coarse grained, with 0.5-1" layers of alternating orange and light brown sand, dry. |
| 28 | | | | | | | |
| 30 | | X | 6 7 7 7 | 100 | | -/60 | 30-32' Light brown-orange SAND, medium to coarse grained. |
| 32 | | | | | | | WET AT 31.5' BGS. |
| 34 | | | | | | | |
| 36 | | X | 6 9 13 13 | 100 | | -/BKG | 35-37' Orange to light brown SAND, medium to coarse grained, loose, saturated. |
| 38 | | X | 9 12 15 16 | 100 | | -/BKG | 37-39' Same as above. |
| 40 | | X | 7 10 13 18 | 100 | | -/BKG | 39-41' Orange to light brown SAND, coarse to medium grained, some lignite, quartz gravel (up to 0.5" in size), wet. |
| 42 | | X | 6 5 4 4 | 100 | | -/BKG | 41-42.5' Light brown SAND with approximately 5% lignite gravel, subrounded, loose, wet. |
| 44 | | X | 4 5 6 14 | 100 | | -/BKG | 42.5-43' Reddish-orange SAND, coarse to medium grained, wet. |
| 46 | | X | 4 7 9 10 | 80 | | -/BKG | 43-44' Brown-orange SAND and GRAVEL, up to 50% gravel (approx. 1" in diameter), rounded to subrounded, loose, moist. |
| 48 | | | | | | | 44-45' Red SILTY CLAY with some fine sand, high plasticity, very stiff, wet. |
| 50 | | | | | | | 45-47' Dark gray SILTY CLAY, some fine sand (MERCHANTVILLE), plastic, very stiff, moist. |
| 52 | | | | | | | |
| 54 | | | | | | | |
| 56 | | | | | | | |

20 slot wire wound stainless steel screen

sand pack



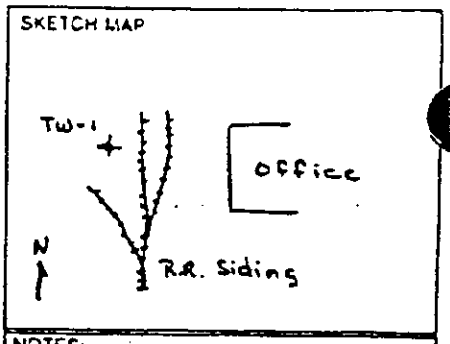
AR306628

WESTON

## DRILLING LOG

WELL NUMBER: TW-1
OWNER: Standard Chlorine
LOCATION: Plant Site, Gov. Lea Road, Delaware City, Del
ADDRESS:
TOTAL DEPTH: 77'
SURFACE ELEVATION: 46.8'
WATER LEVEL: 13.7'
DRILLING COMPANY: A.C. Schultes
DRILLING METHOD: Mud Rotary
DATE DRILLED: 12/17/81
DRILLER: Charlie Sacco
HELPER: Tim Folker
LOG BY: Dan Nickens

SKETCH MAP




NOTES:

| DEPTH (FEET) | GRAPHIC LOG | | SAMPLE NUMBER | SAMPLE TYPE | SAMPLE BLOWS* | DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES) |
|---|---|---|---|---|---|---|
| | 5-6 | | S/SP | | | clay, pink, with pebbles, orange, some sand |
| | 10-11 | | S/SP | | | sand, orange, with pebbles, trace pink clay |
| | 15-16 | COLUMBIA FORMATION | S/SP | | | sand, orange, with pebbles |
| | 20-21 | | S/SP | | | sand, orange, with pebbles, some orange clay |
| 25' | 25-26 | | S/SP | | | pebbles, orange + white, poor recovery |
| | 30-31 | | S/SP | | | sand, orange, with pebbles |
| | 35-36 | | S/SP | | | pebbles, orange and white, poor recovery |
| | 40-41 | | S/SP | | | pebbles, orange and white, poor recovery |
| | 45-46 | | S/SP | | | sand, orange, with pebbles |
| 50' | 50-51 | | S/SP | | | clay, orange, sandy |
| | 55-56 | MERCHANTVILLE (?) | S/SP | | | clay, dark gray at 52' (MERCHANTVILLE ?) clay, dark gray, micaceous |
| | 60-61 | | S/SP | | | clay, dark gray, micaceous |
| | 65-66 | | S/SP | | | clay, dark gray, micaceous, trace pale gray clay 66' – POTOMAC CLAY |
| | 70-71 | POTOMAC CLAY | S/SP | | | clay, light gray |
| 75' | 75-76 | | S/SP | | | clay, mottled pink + light gray |
| | 76-77 | | S/SP | | | clay, mottled pink and light gray |

WIPER-LINE CORE TAKEN BY ALL SAMPLES

* ASTM D1586

SHEET 1 OF 1



AR306629

Well TW-1

# Well Construction Summary

Location or Coords: Standard Chlorine Plant Site, Delaware City, Del.

Elevation: Ground Level 46.8'

Top of Casing 49.9'

## Drilling Summary:

Total Depth 77'

Borehole Diameter 8"

Driller A.C. Schultes
664 S. Evergreen Ave
Woodbury N.J.

Rig Failing Model 1250

Bit(s) Fish tail

Drilling Fluid Quick-Gel Bentonite

Surface Casing 4" Steel Pipe

## Well Design:

Basis: Geologic Log X Geophysical Log ____

Casing String(s): C = Casing S = Screen

| | | | | | |
|---|---|---|---|---|---|
| +3' | 12' | C | | | |
| 12' | 52'6" | S1 | | | |

Casing: C1 ____

C2 ____

Screen: S1 STEEL, 4" DIAM 0.020 INCH SLOTS

S2 ____

Centralizers ____

Filter Material Coarse Sand from James Moore & Co., New Jersey

Cement 10' to Surface

Other Pellet bentonite from 75-77' (1 box) then sand to 10' then 1 box bentonite then grout to surface

## Construction Time Log:

| Task | Start Date | Start Time | Finish Date | Finish Time |
|---|---|---|---|---|
| Drilling: | | | | |
| | 12/17 | 8:30 | 12/17 | 17:00 |
| Geophys. Logging: | | | | |
| Casing: | | | | |
| | 12/17 | 1900 | 12/17 | 1:30 |
| Filter Placement: | 12/17 | 1:30 | 12/17 | 2:30 |
| Cementing: | 12/17 | 2:30 | 12/17 | 3:00 |
| Development: | 12/18 | 8:00 | 12/18 | 3:00 |
| Other: | | | | |

## Well Development:

well developed by swabbing with surge block for several hours then blowing with air

## Comments:

Project Standard Chlorine

Location Delaware City, Del.

Personnel Dan Nickens

Cement Grout

B. Bentonite

Sand

Sand

Sand

75 Bentonite

WESTON

AR306630

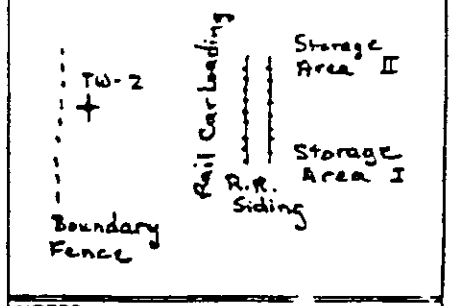
WESTON

DRILLING LOG

WELL NUMBER: TW-2 OWNER: Standard Chlorine
LOCATION: Plant Site, Gov. Lea Rd. ADDRESS:
Delaware City, Del. TOTAL DEPTH: 82'
SURFACE ELEVATION: 52.7' WATER LEVEL: 13.1'
DRILLING COMPANY: A.C. Schultes DRILLING METHOD: Mud Rotary DATE DRILLED: 12/8/81
DRILLER: Charlie Sacco HELPER: Tim Folker

LOG BY: Dan Nickens

SKETCH MAP




NOTES:

| DEPTH (FEET) | GEOLOGIC LOG | SAMPLE NUMBER | SAMPLE TYPE | SAMPLE BLOWS* | DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES) |
|---|---|---|---|---|---|
| 0 | | 5-6 | SS | | 0-2' clay, orange, sandy, then sand, coarse, orange, with pebbles, orange + white |
| | | 10-11 | SS | ALL SAMPLES WITH WIRE LINE CORER | sand, orange, some pebbles and clay |
| | | 15-16 | SS | | pebbles, poor recovery |
| | | 20-21 | SS | | sand, orange and pebbles, poor recovery |
| 25' | | 25-26 | SS | | pebbles, quartz, orange and white, poor recovery |
| | | 30-31 | SS | | sand, orange, coarse, and pebbles, poor recovery |
| | COLUMBIA FORMATION | 35-36 | SS | | sand, coarse, orange and white, some pebbles |
| | | 40-41 | SS | | pebbles, orange and white, rounded, poor recovery |
| | | 45-46 | SS | | pebbles, orange and white, poor recovery |
| 50' | | 50-51 | SS | | pebbles, orange and white, poor recovery |
| | | 55-56 | SS | | sand, coarse, orange, with some pebbles |
| | | 60-61 | SS | | Clay, dark gray, micaceous, starts at 59' |
| | MERCHANTVILLE (?) | 61-62 | SS | | 59' MERCHANTVILLE (?) clay, dark gray |
| | | 65-66 | SS | | clay, dark gray, micaceous |
| 75' | | 70-71 | SS | | clay, dark gray, micaceous, trace white clay |
| | POTOMAC CLAY | 75-76 | SS | | 71' POTOMAC CLAY clay, light gray, plastic |
| | | 80-81 | SS | | clay, light gray, plastic, some pink |
| | | 81-82 | SS | | clay mottled light gray and pink |

* ASTM D1586

SHEET 1 OF 1



AR306631

Well TW-2

# Well Construction Summary

Location or Coords: Standard Chlorine Delaware City, Delaware

Elevation: Ground Level 52.7'

Top of Casing 56.1'

## Drilling Summary:

Total Depth 82'

Borehole Diameter 8"

Driller A.C. Schultes

Rig Failing Model 1250

Bit(s) Fishtail

Drilling Fluid Quick-Gel Bentonite

Surface Casing 4" Steel Pipe

## Well Design:

Basis: Geologic Log X Geophysical Log

Casing String(s): C = Casing S = Screen

| | | | | | |
|---|---|---|---|---|---|
| +3 | 23'3" | C | | | |
| 23'3" | 63'7" | S1 | | | |

Casing: C1

C2

Screen: S1 4" DIAM STEEL, 0.020 INCH SLOTS

S2

Centralizers

Filter Material Coarse Sand from James Moore & Co., New Jersey

Cement 17' to Surface

Other 80-82' filled with pellet Bentonite, then sand to 21' then bentonite to 17' then cement grout to surface

## Construction Time Log:

| Task | Start Date | Start Time | Finish Date | Finish Time |
|---|---|---|---|---|
| Drilling: | 12/8 | 9:30 | 12/8 | 12:30 |
| Geophys. Logging: | | | | |
| Casing: | 12/8 | 1:30 | 12/8 | 2:30 |
| Filter Placement: | 12/8 | 2:30 | 12/8 | 3:30 |
| Cementing: | 12/8 | 3:30 | 12/8 | 4:00 |
| Development: | 12/9 | 8:00 | 12/9 | 4:00 |
| Other: | | | | |

## Well Development:

Well Developed by swabbing with surge block and blowing with air

## Comments:

Location Delaware City, Del.

Personnel Dan Nickens

Project Standard Chlorine

Sand

Cement Grout

2' Bentonite

17'

Sand

Sand

50' Bentonite

WESTON



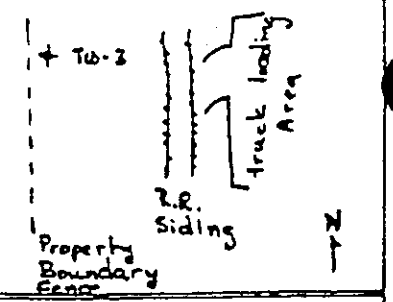
AR306632

WESTON

DRILLING LOG

WELL NUMBER: TW-3 OWNER: Standard Chlorine
LOCATION: Plant Site ADDRESS:
Grov. Lea Road
Delaware City Del TOTAL DEPTH: 82'
SURFACE ELEVATION: 53.4' WATER LEVEL: 12.2'
DRILLING COMPANY: A.C. Schultes DRILLING METHOD: Mud Rotary DATE DRILLED: 12/11
DRILLER: Charlie Secca HELPER: Tim Folker
LOG BY: Dan Nickens

SKETCH MAP




NOTES: Continuous sampling of drilling cuttings collected

| DEPTH (FEET) | GRAPHIC LOG | SAMPLE NUMBER | SAMPLE TYPE | SAMPLE BLOWS | DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES) |
|---|---|---|---|---|---|
| | COLUMBIA FORMATION | | | | 0-4 clay orange and sand orange |
| 5 | | 5-6 | SS | | sand, orange, with some pebbles |
| 10 | | 10-11 | SS | | No sample recovery |
| 15 | | 15-16 | SS | | No sample recovery |
| 20 | | 20-21 | SS | | sand, coarse, orange, with pebbles |
| 25 | | 25-26 | SS | | pebbles, orange and white, poor recovery |
| 30 | | 30-31 | SS | | sand, coarse, orange, with pebbles |
| 35 | | 35-36 | SS | | sand, orange |
| 40 | | 40-41 | SS | | sand, orange, some pebbles |
| 45 | | 45-46 | SS | | sand, orange, some pebbles and some sand, coarse, tan |
| 50 | | 50-51 | SS | | sand, orange, some pebbles |
| 55 | | 55-56 | SS | | sand orange, some pebbles, from 58-59 possible sandstone |
| | | | | | 59' - MERCHANTSVILLE (?) |
| 60 | MERCHANTSVILLE (?) | 60-61 | SS | | clay, dark gray, micaceous, starts at 59' |
| 65 | | 65-66 | SS | | clay, dark gray, micaceous |
| 70 | | 70-71 | SS | | clay, dark gray, micaceous with gray sand (lower 6") |
| 75 | | 75-76 | SS | | clay, dark gray, micaceous with gray sand |
| | | 75-76 | SS | | clay, light gray |
| 80 | | 80-81 | SS | | clay, dark gray, 3" then POTOMAC CLAY AT 80.3 |
| 85 | POTOMAC CLAY | 81-82 | SS | | clay, mottled red and light gray |
| | | | | | clay, mottled red and light gray |

TAKEN WITH WIRE LINE CORER ALL SAMPLES

* ASTM D1586

SHEET 1 OF 1

AR306633

Well TW-3

# Well Construction Summary

Location or Coords: Standard Chlorine, Delaware City, Delaware

Elevation: Ground Level 53.4'
Top of Casing 56.3'

## Drilling Summary:

Total Depth 82'
Borehole Diameter 8"

Driller A.C. Schultes

Rig Failing Model 1250
Bit(s) Fishtail

Drilling Fluid Quick-Gel Bentonite

Surface Casing 4" Steel Pipe

## Well Design:

Basis: Geologic Log X Geophysical Log ____

Casing String(s): C = Casing S = Screen

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| +3 | - | 22'2" | C | | - | | |
| 22'2" | - | 42'8" | S1 | | - | | |
| | - | | | | - | | |
| | - | | | | - | | |
| | - | | | | - | | |
| | - | | | | - | | |
| | - | | | | - | | |
| | - | | | | - | | |

Casing: C1 ____
C2 ____

Screen: S1 Steel, 4" Diam. 0.020 inch slots
S2 ____

Centralizers ____

Filter Material Coarse sand from James Moore & Co., New Jersey
Cement 16' to Surface

Other 80-82 filled with pellet bentonite, then sand to 20' then bentonite to 16' then grout to surface

## Construction Time Log:

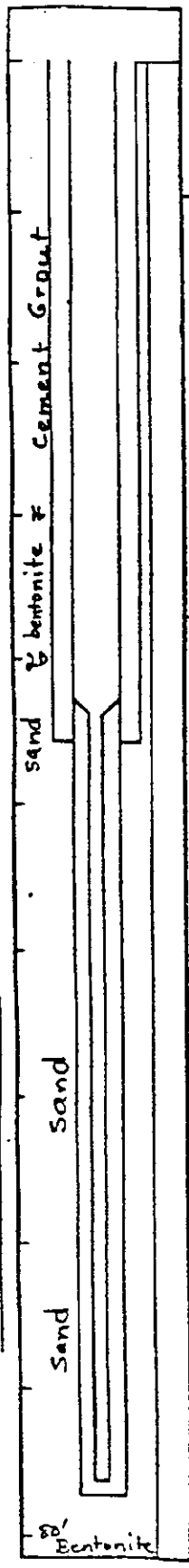
| Task | Start Date | Start Time | Finish Date | Finish Time |
|---|---|---|---|---|
| Drilling: | 12/11 | 9:30 | 12/11 | 12:30 |
| Geophys. Logging: | | | | |
| Casing: | 12/11 | 1:30 | 12/11 | 2:30 |
| Filter Placement: | 12/11 | 2:30 | 12/11 | 3:30 |
| Cementing: | 12/11 | 3:30 | 12/11 | 4:00 |
| Development: | 12/12 | 8:00 | 12:12 | 4:00 |
| Other: | | | | |

## Well Development:

well developed by swabbing with surge block and blowing with air

## Comments:

Location Delaware City, Del.
Personnel Dan Nickens
Project Standard Chlorine




WESTON



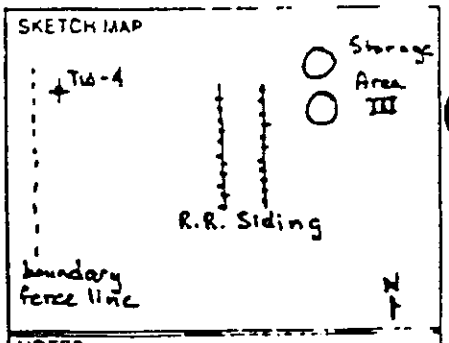
AR306634

WESTON

## DRILLING LOG

WELL NUMBER: TW-4 OWNER: Standard Chlorine
LOCATION: Plant, Gov. Lea. Road, Delaware City, Del ADDRESS:
TOTAL DEPTH: 77'
SURFACE ELEVATION: 52.1' WATER LEVEL: 11.7'
DRILLING COMPANY: A.C. Schultes DRILLING METHOD: Mud Rotary DATE DRILLED: 8/15
DRILLER: Charlie Sacco HELPER: Tim Folker
LOG BY: Don Nickens

SKETCH MAP




NOTES:

| DEPTH (FEET) | DRILLING LOG | SAMPLE NUMBER | SAMPLE TYPE | SAMPLE BLOWS* | DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES) |
|---|---|---|---|---|---|
| | | 5-6 | SS | | 0-4' clay, orange, sandy, then sand, orange, with a few pebbles |
| | | 10-11 | SS | COARSE | sand, dark orangish brown, some pebbles and clay, br |
| | | 15-16 | SS | | sand, orange, and pebbles and clay, orange |
| | | 20-21 | SS | | sand, orange, with pebbles, and some clay, org |
| 25 | COLUMBIA FORMATION | 25-26 | SS | WITH LITTLE | pebbles, orange and white, poor recovery |
| | | 30-31 | SS | | pebbles, orange and white, poor recovery |
| | | 35-36 | SS | | pebbles, poor recovery |
| | | 40-41 | SS | | sand, orange with pebbles |
| | | 45-46 | SS | | pebbles, poor recovery |
| 50 | | 50-51 | SS | | pebbles, poor recovery |
| | | 55-56 | SS | | pebbles, poor recovery |
| | | | | | at 57' clay, dark gray (MERCHANTVILLE ?) |
| | MERCHANTVILLE (?) | 60-61 | SS | | clay, dark gray, micaceous |
| | | 65-66 | SS | | clay, dark gray, micaceous |
| | | 70-71 | SS | SAMPLES TAKEN | clay, dark gray, with quartz pebble, lower 6" mottled w lt. gray |
| 75 | POTOMAC CLAY | 75-76 | SS | | Top 1" clay, dark gray, 75.1' POTOMAC CLAY; lower 11" clay mottled light gray and pink |
| | | 76-77 | SS | | clay, mottled light gray and pink |

*ASTM D1586

SHEET 1 OF 1

AR306635

Well TW-4

# Well Construction Summary

Location or Coords: Standard Chlorine Gov. Lea Rd. Deleware City Del.

Elevation: Ground Level 52.1'

Top of Casing 55.0'

## Drilling Summary:

Total Depth 77'

Borehole Diameter 8"

Driller A.C. Schultes

Rig Failing Model 1250

Bit(s) Fish tail

Drilling Fluid Quick-Gel Bentonite

Surface Casing 4" Steel Pipe

## Well Design:

Basis: Geologic Log X Geophysical Log ____

Casing String(s): C=Casing S=Screen

| | | | | | |
|---|---|---|---|---|---|
| +3 | 22'2" | C | | | |
| 22'2" | 62'6" | S1 | | | |

Casing: C1 ____

C2 ____

Screen: S1 4" DIAM STEEL 0.020 INCH SLOTS

S2 ____

Centralizers ____

Filter Material Coarse Sand from James Moore & Co., New Jersey

Cement 16' to surface

Other 75-77' filled with pellet bentonite, then sand to 20'2" then bentonite to 16'2" then grout to surface

## Construction Time Log:

| Task | Start Date | Start Time | Finish Date | Finish Time |
|---|---|---|---|---|
| Drilling: | 12/15 | 8:30 | 12/15 | 12:30 |
| Geophys. Logging: | | | | |
| Casing: | 12/15 | 1:30 | 12/15 | 2:30 |
| Filter Placement: | 12/15 | 2:30 | 12/15 | 3:30 |
| Cementing: | 12/15 | 3:30 | 12/15 | 4:00 |
| Development: | 12/16 | 8:00 | 12/16 | 9:00 |
| Other: | | | | |

## Well Development:

well developed by swabbing with surge block and blowing with air

## Comments:

Location Delaware City, Del.

Personnel Dan Nickens

Project Standard Chlorine

Sand 20 Bentonite Cement grout

Sand

Sand

75' Bentonite

WESTON



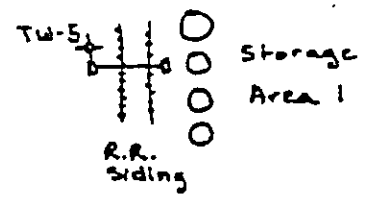
AR306636

WESTON

DRILLING LOG

WELL NUMBER: TW-5 OWNER: Standard Chlorine
LOCATION: Plant Site, Delaware City, Gov. Lea Rd. ADDRESS:
TOTAL DEPTH: 72'
SURFACE ELEVATION: 46.6' WATER LEVEL: 13.1'
DRILLING COMPANY: Schultes DRILLING METHOD: Mud Rotary DATE DRILLED: 12/19/81
DRILLER: Charlie Sacco HELPER: Jim Folker
LOG BY: Dan Nickens

SKETCH MAP




NOTES:

| DEPTH (FEET) | GRAPHIC LOG | SAMPLE NUMBER | SAMPLE TYPE | SAMPLE BLOWS* | DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES) |
|---|---|---|---|---|---|
| 0 | Columbia Formation | 5-6 | SS | | 0-3' clay, orange, sandy, then sand, orange, some quartz pebbles |
| | | 10-11 | SS | | sand, brown |
| | | 15-16 | SS | | sand, brown |
| | | 20-21 | SS | | sand, brown, coarse |
| 25 | | 25-26 | SS | | sand, mottled orange and brown, some sandstone concretions |
| | | 30-31 | SS | | sand, orange |
| | | 35-36 | SS | | sand, orange, few pebbles |
| | | 40-41 | SS | | sand, orange, some concretions |
| | | 45-46 | SS | | sand, orange |
| 50 | | 50-51 | SS | | sand, orange, possible sandstone 51-52' |
| | Merchantville (?) | 55-56 | SS | | 52' becomes clay, dark gray, micaceous (MERCHANTVILLE ?) clay, dark gray, micaceous |
| | | 60-61 | SS | | clay, dark gray, micaceous |
| | | 65-66 | SS | | clay, mottled dark and light gray, lower 4" light gray 65.7' POTOMAC CLAY |
| | Potomac Clay | 70-71 | SS | | clay, mottled pink and light gray |
| 75 | | 71-72 | SS | | clay, mottled pink and light gray |

Air samples taken with wire line core

* ASTM D1586

SHEET 1 OF 1

AR306637

Well TW-5

# Well Construction Summary

Location or Coords: Standard Chlorine Plant Site, Delaware City, Del.

Elevation: Ground Level 46.6'
Top of Casing 50.1'

## Drilling Summary:

Total Depth 72'
Borehole Diameter 8"

Driller A. C. Schultes

Rig Failing Model 1250
Bit(s) Fish tail

Drilling Fluid Quik-Gel Bentonite

Surface Casing 4" Steel Pipe

## Well Design:

Basis: Geologic Log X Geophysical Log

Casing String(s): C = Casing S = Screen

| | | | | | |
|---|---|---|---|---|---|
| +3' | - | 12 | C | - | |
| 12 | - | 52'6" | S1 | - | |

Casing: C1

C2

Screen: S1 STEEL, 4" DIAM 0.020 INCH SLOTS

S2

Centralizers

Filter Material Coarse Sand from James Moore & Co., New Jersey

Cement 8' to surface

Other Pellet Bentonite from 70-72' (1 box) then sand to 10' then bentonite from 10' to 8' then grout to surface.

## Construction Time Log:

| Task | Start Date | Start Time | Finish Date | Finish Time |
|---|---|---|---|---|
| Drilling: | 12/19 | 8:30 | 12/19 | 12:00 |
| Geophys. Logging: | | | | |
| Casing: | 12/19 | 1:00 | 12/19 | 1:30 |
| Filter Placement: | 12/19 | 1:30 | 12/19 | 2:00 |
| Cementing: | 12/19 | 2:00 | 12/19 | 3:00 |
| Development: | 12/21 | 8:00 | 12/21 | 3:00 |
| Other: | | | | |

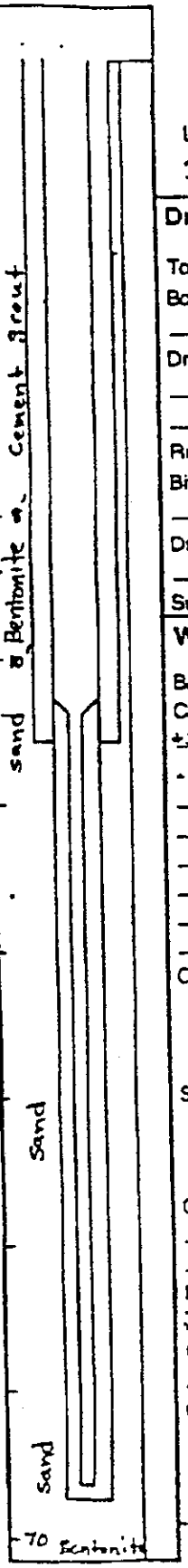
## Well Development:

Well developed by swabbing with surge block for several hours then blowing with air

## Comments:

Location Delaware City, Del.
Personnel Dan Nickens

Project Standard Chlorine




WESTON



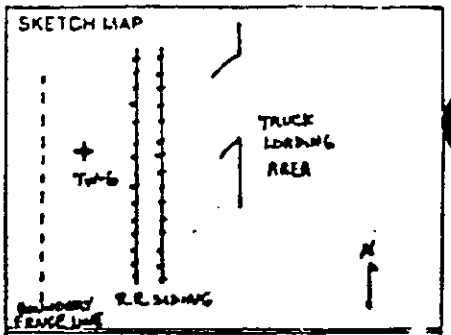
AR306638

WESTON

## DRILLING LOG

WELL NUMBER: TW-6
OWNER: STANDARD CHLORINE
LOCATION: PLANT SITE, SW. IER ROAD, DELAWARE CITY, DELAWARE
ADDRESS:
TOTAL DEPTH: 71'
SURFACE ELEVATION: 47.4'
WATER LEVEL: 12.2'
DRILLING COMPANY: AL SHUGES
DRILLING METHOD: MUD ROTARY
DATE DRILLED: 12/23
DRILLER: S. SACCO
HELPER: T. FOLKER
LOG BY: R. NAMAN

SKETCH MAP




NOTES:

| DEPTH (FEET) | GRAPHIC LOG | SAMPLE NUMBER | SAMPLE TYPE | SAMPLE BLOWS* | DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES) |
|---|---|---|---|---|---|
| | | | | | SURFACE TO 8' - FILL |
| 5 | COLUMBIA FORMATION | 5'-6' | SPLIT SPOON | WITH WIRE-LINE CORE | SAND, ORANGE, WITH PEBBLES |
| 10 | | 10-11 | SS | | PEBBLES, POOR RECOVERY |
| 15 | | 15-16 | SS | | SAND, ORANGE, WITH PEBBLES |
| 20 | | 20-21 | SS | | SAND, ORANGE, MEDIUM |
| 25 | | 25-26 | SS | | PEBBLES, POOR RECOVERY |
| 30 | | 30-31 | SS | | SAND, ORANGE, COARSE |
| 35 | | 35-36 | SS | | SAND, ORANGE, COARSE |
| 40 | | [illegible] | SS | | SAND, ORANGE, COARSE |
| 45 | | 45-46 | SS | | SAND, ORANGE, COARSE |
| 50 | | 50-51 | SS | | SAND, ORANGE, COARSE |
| | | | SS | ALL SAMPLES TAKEN | 51' CLAY, DARK GRAY, MICACEOUS (MERCHANTVILLE ?) |
| 55 | MERCHANTVILLE (?) | 55-56 | | | CLAY, DARK GRAY, MICACEOUS |
| 60 | | 60-61 | SS | | CLAY, DARK GRAY, MICACEOUS |
| 65 | | 65-66 | SS | | CLAY, DARK GRAY, MICACEOUS |
| | | | SS | | 70' - POTOMAC CLAY |
| 70 | POTOMAC CLAY | 70-71 | | | CLAY, LIGHT GRAY AND PINK, MOTTLED |

* ASTM D1586

SHEET 1 OF 1



AR306639

Well TW-6

# Well Construction Summary

Location or Coords: STANDARD CHLORINE PLANT SITE, DELAWARE CITY, DELAWARE

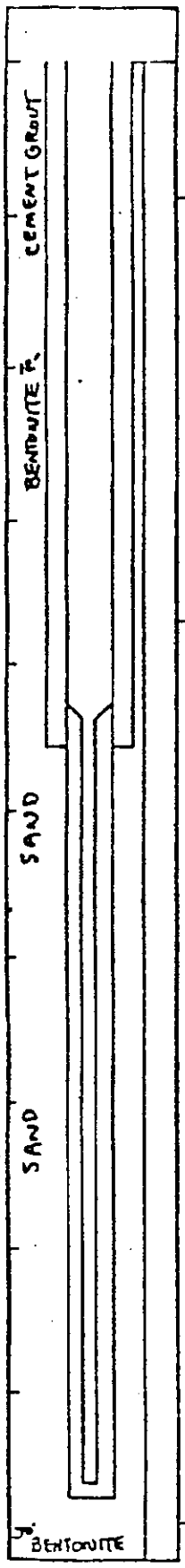
Elevation: Ground Level 47.4'

Top of Casing 50.7'

Location DELAWARE CITY, DELAWARE

Personnel RON NAGAN

Project STANDARD CHLORINE




## Drilling Summary:

Total Depth 71'

Borehole Diameter 8"

Driller A.C. SALVATES
664 S. EVERGREEN AVE.
WOODBURY, N.J.

Rig FAILING HOLEMASTER MODEL 1250

Bit(s) FISH-TAIL

Drilling Fluid QUICK GEL BENTONITE

Surface Casing 4" STEEL PIPE

## Well Design:

Basis: Geologic Log X Geophysical Log ___

Casing String(s): C = Casing S Screen

| | | | | | |
|---|---|---|---|---|---|
| +3 | 18'9" | C | | | |
| 18'9" | 58'9" | S1 | | | |

Casing: C1 ___

C2 ___

Screen: S1 STEEL, 4" DIAM. 0.020 INCH SLOTS

S2 ___

Centralizers ___

Filter Material COARSE SAND FROM J. MOORE & CO., NEW JERSEY

Cement 12' TO SURFACE

Other BENTONITE PELLETS AT BASE THEN SAND TO 15' THEN BENTONITE PELLETS THEN GROUT TO SURFACE

## Construction Time Log:

| Task | Start Date | Start Time | Finish Date | Finish Time |
|---|---|---|---|---|
| Drilling: | 12/23 | 8:00 | 12/23 | 10:30 |
| Geophys. Logging: | | | | |
| Casing: | 12/23 | 10:30 | 12/23 | 11:30 |
| Filter Placement: | 12/23 | 11:30 | 12/23 | 12:00 |
| Cementing: | 12/23 | 12:00 | 12/23 | 12:30 |
| Development: | 12/28 | 8:00 | 12/29 | 8:00 |
| Other: | | | | |

## Well Development:

WELL DEVELOPED BY SWABBING WITH SURGE PLUNGER FOR SEVERAL HOURS FOLLOWED BY AIR BLOWING.

## Comments:

WESTON

AR306640

Well TW-6A

# Well Construction Summary

Location or Coords: STANDARD CHLORINE PLANT SITE, DELAWARE CITY, DE

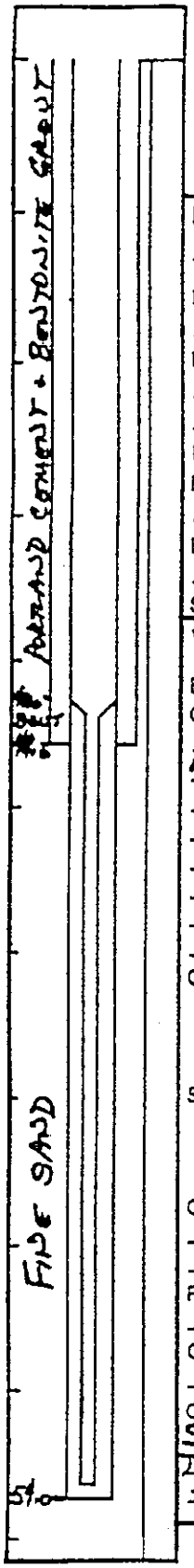
Elevation: Ground Level

Top of Casing

Location: DELAWARE CITY, DE

Personnel: DAN NICKENS

Project: STANDARD CHLORINE




## Drilling Summary:

Total Depth 54.0'

Borehole Diameter 8"

Driller C.Z. ENTERPRISES

Rig MUD ROTARY

Bit(s) HAWTHORNE

Drilling Fluid BENTONITE MUD + CLEAN WATER

Surface Casing 4" IRON PIPE

## Well Design:

Basis: Geologic Log ✓ Geophysical Log

Casing String(s): C=Casing S=Screen

| | | | | | |
|---|---|---|---|---|---|
| 0 | - 44.0 | C1 | | - | |
| 44.0 | - 54.0 | S1 | | - | |

Casing: C1 4" DIAM BLACK IRON

C2

Screen: S1 4" DIAM GALVANIZED IRON 0.010 SLOT

S2

Centralizers

Filter Material #1 CAPE MAY GRAVEL

Cement PORTLAND CEMENT

Other BENTONITE PELLET SEAL OVER SCREEN, 2' THICK, FROM -40.0 TO -42.0

## Construction Time Log:

| Task | Start Date | Start Time | Finish Date | Finish Time |
|---|---|---|---|---|
| Drilling: | 4/6 | 1230 | 4/6 | 1700 |
| | 4/7 | 0800 | 4/7 | 1200 |
| Geophys. Logging: | | | | |
| Casing: | 4/7 | 1400 | 4/7 | 1600 |
| Filter Placement: | 4/7 | 1200 | 4/7 | 1400 |
| Cementing: | 4/7 | 1600 | 4/7 | 1800 |
| Development: | 4/8 | 0800 | 4/8 | 1200 |
| Other: | | | | |

## Well Development:

WELL DEVELOPED BY SURGE BLOCK AND AIR PUMPING FOR SEVERAL HOURS UNTIL SAND FREE

## Comments:

WESTON DESIGNERS CONSULTANTS



AR306641

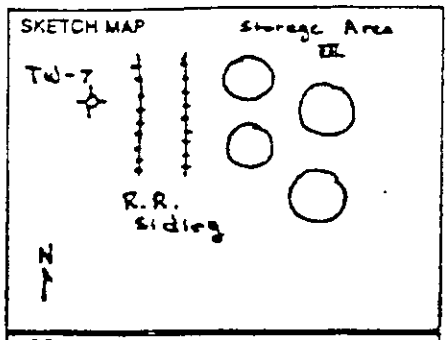
WESTON

DRILLING LOG

WELL NUMBER: TW-7 OWNER: Standard Chlorine
LOCATION: Plant Site, Delaware City, Gov. Lea. Rd ADDRESS:
TOTAL DEPTH: 72'
SURFACE ELEVATION: 47.1' WATER LEVEL: 11.4'
DRILLING COMPANY: Schultes DRILLING METHOD: Mud Rotary DATE DRILLED: 12/21/81
DRILLER: Charlie Sacco HELPER: Tim Folker

LOG BY: Dan Nickens

SKETCH MAP




NOTES:

| DEPTH (FEET) | DRAWING LOG | SAMPLE NUMBER | SAMPLE TYPE | SAMPLE BLOWS* | DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES) |
|---|---|---|---|---|---|
| 0 | COLUMBIA FORMATION | 5-6' | SS | ALL SAMPLES TAKEN WITH WIRELINE CORE BOX | sand, orange, with pebbles, quartz |
| | | 10-11' | SS | | sand, orange, with pebbles, quartz |
| | | 15-16' | SS | | pebbles, quartz, poor recovery |
| | | 20-21 | SS | | sand, orange, with pebbles, quartz |
| 25 | | 25-26 | SS | | pebbles, quartz, poor recovery |
| | | 30-31 | SS | | sand, orange, some pebbles, quartz |
| | | 35-36 | SS | | sand, orange |
| | | 40-41 | SS | | sand, orange |
| | | 45-46 | SS | | sand, orange, some pebbles, quartz and some pebble size sandstone concretions, reddish-brown |
| 50 | | 50-51 | SS | | pebbles, quartz, and some sandstone concretions |
| | | 55-56 | SS | | sand ~~stone~~, 54½ - 55', then 55' MERCHANTVILLE (?) clay, dark gray, micaceous |
| | MERCHANTVILLE (?) | 60-61 | SS | | clay, dark gray mixed with green, micaceous |
| | | 65-66 | SS | | 65.8' - POTOMAC CLAY clay, dark gray, green, micaceous, lower 4" gray clay |
| | POTOMAC CLAY | 70-71 | SS | | clay, mottled pink and light gray |
| 75 | | 71-72 | SS | | sand, brown, with pebbles (possibly settlement) |

*ASTM D1586

SHEET 1 OF 1

AR306642

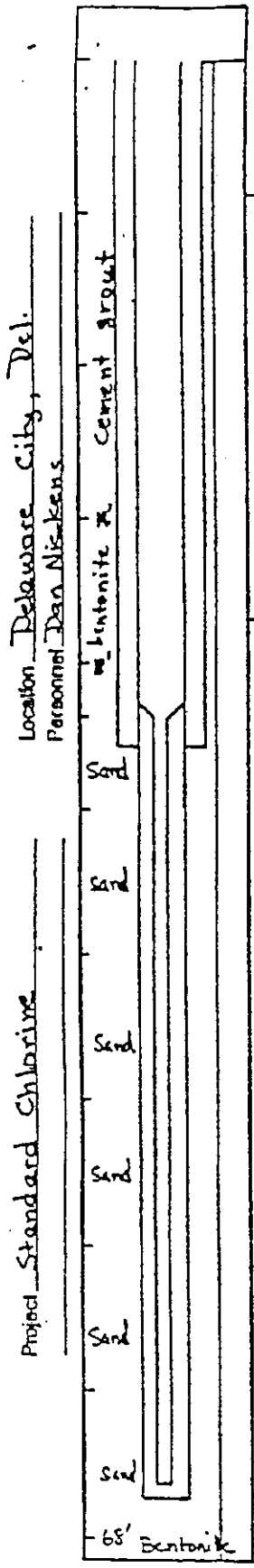
Well TW-7

# Well Construction Summary

Location or Coords: Standard Chlorine Plant Site, Delaware City

Elevation: Ground Level 47.1'

Top of Casing 50.4'




## Drilling Summary:

Total Depth 72'

Borehole Diameter 8"

Driller A.C. Schultes

Rig Failing Model 1250

Bit(s) Fish tail

Drilling Fluid Quik-Gel Bentonite

Surface Casing Steel, 4"

## Well Design:

Basis: Geologic Log X Geophysical Log ____

Casing String(s): C = Casing S = Screen

| | | | | | |
|---|---|---|---|---|---|
| +3 | 35'3" | C | | | |
| 35'3" | 58'6" | S1 | | | |

Casing: C1 ____

C2 ____

Screen: S1 STEEL, 4" DIAM 0.020 INCH SLOTS

S2 ____

Centralizers ____

Filter Material Coarse Sand from James Moore + Co., New Jersey

Cement 14' to surface

Other Pellet Bentonite from 68-72' (2 boxes) then sand to 18' then pellet bentonite to 14' (two boxes) then grout to surface

## Construction Time Log:

| Task | Start Date | Start Time | Finish Date | Finish Time |
|---|---|---|---|---|
| Drilling: | 12/21 | 8:30 | 12/21 | 12:00 |
| Geophys. Logging: | | | | |
| Casing: | 12/21 | 48:00 | 12/21 | 1:30 |
| Filter Placement: | 12/21 | 1:30 | 12/21 | 2:00 |
| Cementing: | 12/21 | 2:00 | 12/21 | 3:00 |
| Development: | 12/22 | 8:00 | 12/22 | 3:00 |
| Other: | | | | |

## Well Development:

Well developed by swabbing with surge block for several hours then blowing with air

## Comments:

WESTON



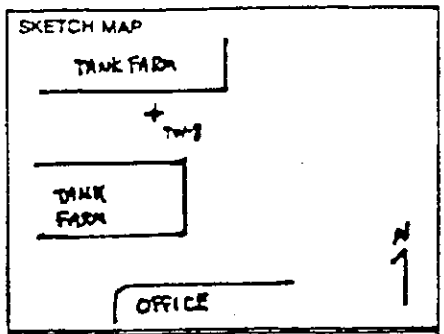
AR306643

WESTON

## DRILLING LOG

WELL NUMBER: TW-8
OWNER: STANDARD CHLORINE
LOCATION: PLANT SITE
GOLLEA ROAD
DELAWARE CITY, DELAWARE
ADDRESS:
TOTAL DEPTH: 75
SURFACE ELEVATION: 52.0'
WATER LEVEL: 12.5'
DRILLING COMPANY: A.C. SERVICES
DRILLING METHOD: MUD ROTARY
DATE DRILLED: 12/22/81
DRILLER: A. HAMMOND
HELPER:
LOG BY: R. NAMAN

SKETCH MAP




NOTES:

| DEPTH (FEET) | GRAPHIC LOG | SAMPLE NUMBER | SAMPLE TYPE | SAMPLE BLOWS* | DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES) |
|---|---|---|---|---|---|
| | | | | | SURFACE TO 3' - FILL |
| 5 | COLUMBIA FORMATION | 5-6 | SPLIT SPOON | | CLAY, ORANGE, WITH SOME SAND |
| 10 | | 10-11 | SS | | CLAY, ORANGE, WITH SOME PEBBLES |
| 15 | | 15-16 | SS | COLLECTED | SAND, ORANGE AND YELLOW, WITH SOME PEBBLES |
| 20 | | 20-21 | SS | | SAND, ORANGE, WITH SOME PEBBLES |
| 25 | | 25-26 | SS | | PEBBLES WITH SOME CLAY |
| 30 | | 30-31 | SS | | SAND, ORANGE, WITH SOME PEBBLES |
| 35 | | 35-36 | SS | | PEBBLES, POOR RECOVERY |
| 40 | | 40-41 | SS | | PEBBLES, POOR RECOVERY |
| 45 | | 45-46 | SS | | SAND, TAN |
| 50 | | 50-51 | SS | | SAND, ORANGE, MEDIUM |
| 55 | | 55-56 | SS | | SAND, ORANGE, MEDIUM |
| 60 | | 60-61 | SS | | 57' HARDPAN-SANDSTONE LENS — 60' MERCHANTVILLE (?) CLAY, DARK GREY, MICACEOUS |
| 65 | MERCHANTVILLE (?) | 65-66 | SS | | CLAY, DARK GRAY, MICACEOUS |
| 70 | | 70-71 | SS | | CLAY, DARK GRAY, MICACEOUS |
| 75 | | 75-76 | SS | | 75' — POTOMAC CLAY CLAY, LIGHT GRAY AND PINK, MOTTLED |
| | POTOMAC CLAY | | | ALL SAMPLES TAKEN WITH WIDER LINE | |

* A.S.T.M. D1586

SHEET 1 OF 1



AR306644

Well Tw-5

# Well Construction Summary

Location or Coords: STANDARD CHLORINE PLANT SITE, DELAWARE CITY, DELAWARE

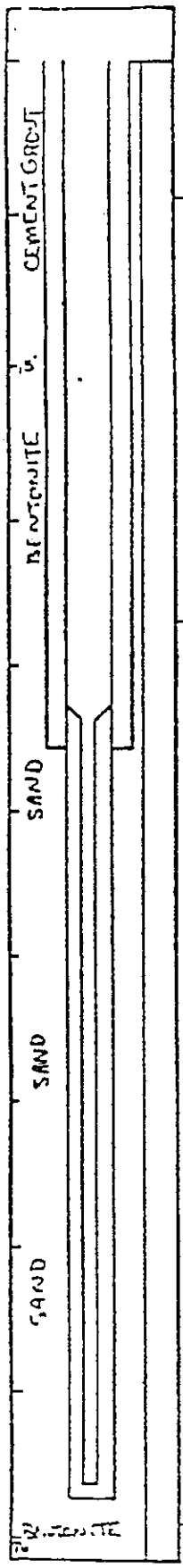
Elevation: Ground Level 52.0'

Top of Casing 52.2'

Location DELAWARE CITY, DELAWARE

Personnel RON NAMAN

Project STANDARD CHLORINE




## Drilling Summary:

Total Depth 76

Borehole Diameter 8"

Driller A.C. SHOLTES
644 S. EVERGREEN AVE.
WOODBURY, N.J.

Rig FAILING IMPERIAL MODEL 1250

Bit(s) FISH TAIL

Drilling Fluid QUICK-GEL BENTONITE

Surface Casing 4" STEEL PIPE

## Well Design:

Basis: Geologic Log X Geophysical Log ___

Casing String(s): C = Casing S = Screen

| | | | | | |
|---|---|---|---|---|---|
| 0 | 21'9" | C | | | |
| 21'9" | 61'9" | SL | | | |

Casing: C1 ___

C2 ___

Screen: S1 STEEL, 4" DIAM 0.020 INCH SLOTS

S2 ___

Centralizers ___

Filter Material COARSE SAND (#10 GRAVEL) FROM J. MOORE & CO NEW JERSEY

Cement 15' TO SURFACE

Other 1 BOX BENTONITE PELLETS AT BASE THEN SAND TO 26' THEN BENTONITE PELLET SEALER (2 BOXES) THEN GROUT (CEMENT) TO SURFACE.

## Construction Time Log:

| Task | Start Date | Start Time | Finish Date | Finish Time |
|---|---|---|---|---|
| Drilling: | 12/22 | 8:30 | 12/22 | [illegible] |
| Geophys. Logging: | | | | |
| Casing: | 12/22 | 2:00 | 12/22 | [illegible] |
| Filter Placement: | 12/22 | 3:00 | 12/22 | 3:30 |
| Cementing: | 12/22 | 3:30 | 12/22 | 4:00 |
| Development: | 12/23 | 8:00 | 12/23 | 8:00 |
| Other: | | | | |

## Well Development:

WELL DEVELOPED BY SURGING WITH SURGE PLUNGER FOR SEVERAL HOURS FOLLOWED BY AIR BLOWING

## Comments:

WESTON

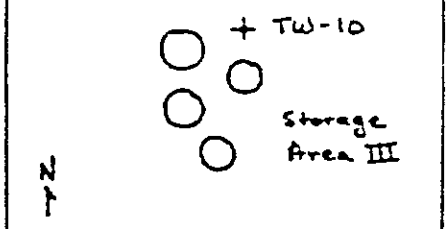
AR306645

WESTON

DRILLING LOG

WELL NUMBER: TW-10 OWNER: Standard Chlorine
LOCATION: Plant Site, Delaware City, Gov. Lea Road ADDRESS:
TOTAL DEPTH 72
SURFACE ELEVATION: 50.5' WATER LEVEL: 11.2'
DRILLING COMPANY: Schultes DRILLING METHOD: Mud Rotary DATE DRILLED: 12/12/81
DRILLER: Charlie Sacco HELPER: Tim Folker
LOG BY: Dan Nickens

SKETCH MAP




NOTES:

| DEPTH (FEET) | GRAPHIC LOG | SAMPLE NUMBER | SAMPLE TYPE | SAMPLE BLOWS* | DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES) |
|---|---|---|---|---|---|
| 0 | Columbia Formation | 5-6 | SS | All samples taken with wire line core | 0-3' clay, orange, sandy, then sand, orange, clayey with trace black sand |
| | | 6-11 | SS | | sand, medium to coarse, orange and yellow |
| | | 15-16 | SS | | sand, orange, clayey, with pebbles |
| | | 20-21 | SS | | sand, coarse, orange |
| 25' | | 25-26 | SS | | sand, coarse, pale-orange |
| | | 30-31 | SS | | sand, orange, with pebbles and some orange clay |
| | | 35-36 | SS | | sand, pale-orange, some pebbles |
| | | 40-41 | SS | | sand, orange |
| | | 45-46 | SS | | sand, orange |
| 50' | | 50-51 | SS | | sand, orange |
| | | 55-56 | SS | | sand, orange |
| | | 60-61 | SS | | sand, orange |
| | Merchantville (?) | 65-66 | SS | | 61-62' sandstone, then at 62' clay, dark gray, clay, dark gray, micaceous |
| | | 70-71 | SS | | Merchantville (?) Top "2" clay, dark gray, micaceous then 3" clay, light gray, then lower 7" clay, mottled pink and light gray |
| 75' | Potomac Clay | 71-72 | SS | | 70.5' Potomac Clay clay, mottled pink and light gray |

* ASTM D1586

SHEET 1 OF 1

AR306646

Well TW-1D

# Well Construction Summary

Location or Coords: Standard Chlorine Plant Site, Delaware City, Del.

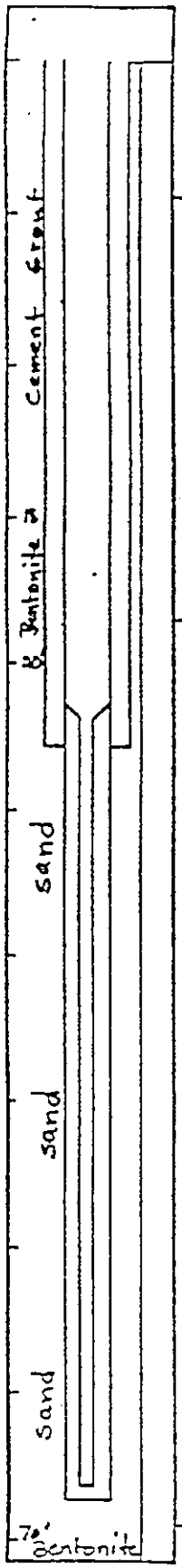
Elevation: Ground Level 50.5'

Top of Casing 50.5'

Location Delaware City, Del.

Personnel Dan Nickens

Project Standard Chlorine




## Drilling Summary:

Total Depth 72'

Borehole Diameter 8"

Driller A.C. Schultes

Rig Failing Model 1250

Bit(s) Fish Tail

Drilling Fluid Quik-Gel Bentonite

Surface Casing 4" Steel Pipe

## Well Design:

Basis: Geologic Log X Geophysical Log ____

Casing String(s): C = Casing S = Screen

| | | | | | |
|---|---|---|---|---|---|
| +D | - 22'3" | C | | - | |
| 22'3" | - 62'9" | S1 | | - | |
| | - | | | - | |
| | - | | | - | |
| | - | | | - | |
| | - | | | - | |
| | - | | | - | |
| | - | | | - | |

Casing: C1

C2

Screen: S1 STEEL, 4" DIAM. 0.020 INCH SLOTS

S2

Centralizers

Filter Material Coarse Sand from James Moore & Co., New Jersey

Cement 18' to Surface

Other Pellet bentonite from 70-72' (1 box) then sand to 20' then bentonite from 20-18' then grout to surface

## Construction Time Log:

| Task | Start Date | Start Time | Finish Date | Finish Time |
|---|---|---|---|---|
| Drilling: | 12/18 | 8:30 | 12/18 | 12:00 |
| Geophys. Logging: | | | | |
| Casing: | 12/18 | 1:00 | 12/18 | 1:30 |
| Filter Placement: | 12/18 | 1:30 | 12/18 | 2:00 |
| Cementing: | 12/18 | 2:00 | 12/18 | 2:30 |
| Development: | 12/19 | 8:00 | 12/19 | 3:00 |
| Other: | | | | |

## Well Development:

Well developed by swabbing with surge block for several hours then blowing with air

## Comments:

WESTON



AR306647

WESTON

## DRILLING LOG

WELL NUMBER: 22
OWNER: Standard Chlorine
LOCATION: East boundary in field
ADDRESS:
TOTAL DEPTH 73'
SURFACE ELEVATION:
WATER LEVEL ~40'
DRILLING COMPANY: Walton
DRILLING METHOD: Auger
DATE DRILLED: 10/26/82
DRILLER:
HELPER:
LOG BY: R. Johnson

SKETCH MAP

NOTES:
No odor in samples

| DEPTH (FEET) | GRAPHIC LOG | SAMPLE NUMBER | SAMPLE TYPE | SAMPLE BLOWS* | DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES) |
|---|---|---|---|---|---|
| 0 | | | | | 0 - 39.0' No sampling |
| | | | | | 0 - 5.0' Brown SAND with some medium coarse gravel (fill) |
| | | | | | 5.0 - 39.0' Light brown medium SAND, trace fine gravel |
| | | | | | (hole dry overnight) |
| 39 | | S1 | SS | 4 8 10 | 39.0 - 40.5' Brown, iron stained medium SAND, trace fine |
| | | | | | sand and fine gravel, end of spoon moist |
| | | | | | (saturated sand at 40') |
| | | | | | |
| | | | | | |
| 4 | | S2 | SS | 6 8 14 | 44.0 - 45.5' Tan medium coarse SAND, trace fine gravel |
| 45 | | | | | (water used to clean auger before sampling |
| | | | | | from 45' down) |
| | | | | | |
| | | | | | |
| 9 | | S3 | SS | 5 8 9 | 49.0 - 50.5' Light brown fine to medium SAND |
| 50 | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| 55 | | S4 | SS | 11 11 11 | 54.0 - 55.5' Light brown medium SAND with iron stain |

* ASTM D1586

SHEET 1 OF 2

AR306648

WESTON

DRILLING LOG

WELL NUMBER: 22 (cont) OWNER: Standard Chlorine
LOCATION: ADDRESS:
TOTAL DEPTH
SURFACE ELEVATION: WATER LEVEL:
DRILLING COMPANY: DRILLING METHOD: DATE DRILLED:
DRILLER: HELPER:
LOG BY:

SKETCH MAP

NOTES:
Grout - 1 bag cement, 5 lbs bentonite, 30 gal water

| DEPTH (FEET) | GRAPHIC LOG | SAMPLE NUMBER | SAMPLE TYPE | SAMPLE BLOWS* | DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES) |
|---|---|---|---|---|---|
| 55 | | | | | |
| 59 | | | | | |
| 60 | | S5 | SS | 7 10 11 | 59.0+ - 60.5' Light brown medium-coarse SAND, trace fine gravel, trace limonite flecks |
| 64 | | | | | |
| 65 | | S6 | | 8 13 24 | 64.0 - 65.5' Brown SAND with little medium gravel and silt |
| 69 | | | | | |
| 23.1 70 | | S7 | | 11 19 47 20 | 69.0 - 70.5' Dense grey rust, mottled SILT and fine SAND with trace clay; very slight plastic; approx. 8" recovery |
| | | S8 | | 24 32 30 | 70.5 - 72.0' Very dense grey-rust mottled SILT with little fine sand and clay, slightly plastic |
| | | S9 | | 68 8" | |
| 75 | | | | | 72.0 - 73.0' Same as S8; completed at 73'; grouted hole |

* ASTM D1586

AR304049

SHEET 2 OF 2

Well TW-22

# Well Construction Summary

Location or Coords: _____ Elevation: Ground Level _____

Top of Casing _____

## Drilling Summary:

Total Depth 69.0

Borehole Diameter 9 inches

Driller T. Seward

Rig Simco 5000 WS

Bit(s) 8 3/4 inches

Drilling Fluid Bentonite Mud

Surface Casing NA

## Construction Time Log:

| Task | Start Date | Start Time | Finish Date | Finish Time |
|---|---|---|---|---|
| Drilling: | | | | |
| Geophys. Logging: | | | | |
| Casing: | | | | |
| Filter Placement: | | | | |
| Cementing: | | | | |
| Development: | | | | |
| Other: | | | | |

## Well Design:

Basis: Geologic Log X Geophysical Log ____

Casing String(s): C = Casing S = Screen

| | | | | | |
|---|---|---|---|---|---|
| +2 | -59 | C | | | |
| -59 | -69 | S | | | |

Casing: C1 61 feet of 4 inch diameter, threaded

C2 iron pipe

Screen: S1 10 feet, 0.010 slot, 4 inch diameter,

S2 threaded iron screen

Centralizers _____

Filter Material Grade 1 sand, 2 bgs

Cement 2:1 cement/bentonite

Other _____

## Well Development:

development time 3 days

development water discharged to tanker truck for treatment in solvent recovery

## Comments:

WESTON



AR306650

WESTON

DRILLING LOG

WELL NUMBER: 24 OWNER: Standard Chlorine

LOCATION: NE of plant boundary ADDRESS:

TOTAL DEPTH

SURFACE ELEVATION: WATER LEVEL:

DRILLING COMPANY: Walton DRILLING METHOD: Auger DATE DRILLED: 10/28/82

DRILLER: G. Truver HELPER:

LOG BY: R. Johnson

SKETCH MAP

NOTES:

| DEPTH (FEET) | GRAPHIC LOG | SAMPLE NUMBER | SAMPLE TYPE | SAMPLE BLOWS | DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES) |
|---|---|---|---|---|---|
| 0 | | | | | 0 - 39.0' No sampling |
| | | | | | Light brown medium SAND, trace clay, trace gravel, damp., slightly plastic |
| 39 | | S1 | SS | 1 3 5 | 39.0 - 40.5' Brown moist medium SAND |
| 44 | | | | | 44.0' Started to clean hole with water before sampling |
| 45 | | S2 | SS | 8 11 11 | 44.0 - 45.5' Brown moist medium SAND |
| 49 | | | | | |
| 50 | | S3 | SS | 8 10 11 | 49.0 - 50.5' Brown moist medium SAND |
| 54 | | | | | |
| 55 | | S4 | SS | 13 14 23 | 54.0 - 55.5' Medium-coarse SAND and fine GRAVEL |

AR306621

SHEET 1 OF 2

WESTON

## DRILLING LOG

WELL NUMBER: 24 (cont)- OWNER: Standard Chlorine

LOCATION: ADDRESS:

TOTAL DEPTH

SURFACE ELEVATION: WATER LEVEL:

DRILLING COMPANY: DRILLING METHOD: DATE DRILLED:

DRILLER: HELPER:

LOG BY:

SKETCH MAP

NOTES:

| DEPTH (FEET) | GRAPHIC LOG | SAMPLE NUMBER | SAMPLE TYPE | SAMPLE BLOWS* | DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES) |
|---|---|---|---|---|---|
| 55 | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| 59 | | | | | |
| | | S5 | SS | 15 16 16 | 59.0 - 60.5' Medium-coarse SAND and fine gravel, trace recovery |
| | | | | | NO MERCHANTVILLE |
| | | | | | 64.0 POTOMAC FM. |
| 64 | | | | | |
| 64.5 | | S6 | SS | 19 39 66 10 | 64.0 - 65.5' Dense grey-rust mottled fine SAND, some silt, non-plastic, 1.2' recovery |
| | | S7 | SS | 14 14 9 16 | 65.5 - 67.0' Grey rust, mottled SILT, some fine sand and a trace clay, slightly plastic |
| | | S8 | SS | 39 | 67.0 - 68.5' Grey rust, mottled SILT, some fine sand and a trace clay, slightly plastic |
| 68.5 | | | | | |
| 70 | | | | | End of boring - 68.5' |
| | | | | | Grouted hole - 1 bag cement, 5 lbs bentonite 20 gal water |
| | | | | | |
| 75 | | | | | |

* A.S.T.M. D1586

AR306652

SHEET 2 OF 2

Well TW-24

# Well Construction Summary

Location or Coords: _____ Elevation: Ground Level _____

Top of Casing _____

## Drilling Summary:

Total Depth 64.0

Borehole Diameter 9 inches

Driller T. Seward

Rig Simco 5000 WS

Bit(s) 8 3/4 inches

Drilling Fluid bentonite mud

Surface Casing NA

## Construction Time Log:

| Task | Start Date | Start Time | Finish Date | Finish Time |
|---|---|---|---|---|
| Drilling: | | | | |
| Geophys. Logging: | | | | |
| Casing: | | | | |
| Filter Placement: | | | | |
| Cementing: | | | | |
| Development: | | | | |
| Other: | | | | |

## Well Design:

Basis: Geologic Log X Geophysical Log ____

Casing String(s): C = Casing S = Screen

| | | |
|---|---|---|
| +2 | -54 | C |
| -54 | -64 | S |

Casing: C1 56 feet of 4 inch diameter, threaded iron pipe

C2

Screen: S1 10 feet, 0.010 slot, 4 inch diameter, threaded iron screen

S2

Centralizers

Filter Material Grade 1 gravel

Cement 2:1 cement/bentonite

Other

## Well Development:

development time by air, 2 days

development water discharged to tanker truck for treatment in solvent recover

## Comments:

Project Stanford Location Delaware City, DE

Personnel T. Drew



AR306653

WESTON DESIGNERS CONSULTANTS

WESTON

## DRILLING LOG

WELL NUMBER: 25
OWNER: Standard Chlorine
LOCATION: East side of plant area
ADDRESS:
TOTAL DEPTH: 77
SURFACE ELEVATION:
WATER LEVEL: ~37.5'
DRILLING COMPANY: Walton
DRILLING METHOD: Auger
DATE DRILLED: 10/28/82
DRILLER: G. Truver
HELPER:
LOG BY: R. Johnson

SKETCH MAP

NOTES:
No odors in samples

| DEPTH (FEET) | GRAPHIC LOG | SAMPLE NUMBER | SAMPLE TYPE | SAMPLE BLOWS* | DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES) |
|---|---|---|---|---|---|
| 0 | | | | | 0 - 39.0' No sampling |
| | | | | | 1.0 - 3.0' Sand and gravel fill |
| | | | | | 3.0 Medium brown SAND, trace fine gravel |
| | | | | | (rod wet - 37.5') |
| 39 | | S1 | SS | 4 6 8 | 39.0 - 40.5' Brown medium SAND with trace carbon flecs |
| 44 | | S2 | SS | 5 6 9 | 44.0 - 45.0' Brown medium SAND with trace carbon flecs |
| 49 | | S3 | SS | 5 6 9 | 49.0 - 50.5' Brown medium SAND with trace carbon flecs |
| 55 | | S4 | | 8 9 | 54.0 - 55.5' |

* A.S.T.M. D1586

AR306654

SHEET 1 OF 3

D-64

WESTON

DRILLING LOG

WELL NUMBER: 25 (cont) OWNER: Standard Chlorine
LOCATION: ADDRESS:
TOTAL DEPTH
SURFACE ELEVATION: WATER LEVEL:
DRILLING COMPANY: DRILLING METHOD: Auger DATE DRILLED:
DRILLER: HELPER:
LOG BY:

SKETCH MAP

NOTES:

| DEPTH (FEET) | GRAPHIC LOG | SAMPLE NUMBER | SAMPLE TYPE | SAMPLE BLOWS* | DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES) |
|---|---|---|---|---|---|
| 55 | | | | | |
| 59 | | | | | |
| 60 | | S5 | SS | 12 14 18 | 59.0 - 60.5' Light brown medium SAND |
| 64 | | | | | |
| 65 | | S6 | SS | 12 13 16 | 64.0 - 65.5' No recovery, medium-coarse SAND with little fine gravel (from auger) |
| | | | | | NO MERCHANTVILLE |
| | | | | | 69.0 POTOMAC FM. |
| 69 -22.2 70 | | S7 | SS | 50 50/3" | 69.0 - 69.7' Grey/rust mottled fine SAND, trace silt and clay, 5" recovery |
| | | S8 | SS | 21 52 52/3" | 70.5 - 71.8' Grey/rust mottled fine SAND, trace silt and clay |
| | | S9 | | 50/3" 46 50/ 2 | |
| 74 | | | | | 72.0 - No recovery |
| | | S10 | | 30 50 | 74.0 - 75.8' Fine SAND mottled, iron concentration, thin |

* A.S.T.M. D1586

AR306655 SHEET 2 OF 3

WESTON

## DRILLING LOG

WELL NUMBER: 25 (cont)
OWNER: Standard Chlorine
LOCATION:
ADDRESS:
TOTAL DEPTH
SURFACE ELEVATION:
WATER LEVEL:
DRILLING COMPANY:
DRILLING METHOD:
DATE DRILLED:
DRILLER:
HELPER:
LOG BY:

SKETCH MAP

NOTES:

| DEPTH (FEET) | GRAPHIC LOG | SAMPLE NUMBER | SAMPLE TYPE | SAMPLE BLOWS* | DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES) |
|---|---|---|---|---|---|
| 75 | | | | | 74.0 - 75.8' clay laminaes throughout |
| | | | | 50/90 | |
| | | | | 4 | 75.5 - 76.0' Grey rust mottled clay, some fine sand laminar |
| | | S11 | SS | 20 13 | 76.0 - 77.0' Mottled clay (grey/rust) with some silt and fine sand |
| | | | | | End of boring |
| | | | | | Grout - 1½ bags cement, 10 lbs bentonite, 30 gal water |

* A.S.T.M. D1586

AR306656

SHEET 3 OF 3

Well TW-25

# Well Construction Summary

Location or Coords: _____ Elevation: Ground Level _____

Top of Casing _____

## Drilling Summary:

Total Depth 69.0

Borehole Diameter 9 inches

Driller T. Seward

Rig Simco 5000 WS

Bit(s) 8 3/4 inches

Drilling Fluid bentonite mud

Surface Casing NA

## Construction Time Log:

| Task | Start Date | Start Time | Finish Date | Finish Time |
|---|---|---|---|---|
| Drilling: | | | | |
| Geophys. Logging: | | | | |
| Casing: | | | | |
| Filter Placement: | | | | |
| Cementing: | | | | |
| Development: | | | | |
| Other: | | | | |

## Well Design:

Basis: Geologic Log X Geophysical Log ____

Casing String(s): C = Casing S = Screen

| | | | | | |
|---|---|---|---|---|---|
| +2 | -59 | C | | | |
| -59 | -69 | S | | | |

Casing: C1 61 feet of 4 inch diameter, threaded black iron pipe

C2 _____

Screen: S1 10 feet, 0.010 slot, 4 inch diameter, threaded iron screen

S2 _____

Centralizers _____

Filter Material Grade 1 gravel

Cement 2:1 cement/bentonite

Other _____

## Well Development:

well development by air, 2 days

development water discharged to tanker truck for treatment in solvent recovery

## Comments:

Project Standard Operating Procedure

Location TW-25

Personnel T. Drew

WESTON DESIGNERS CONSULTANTS

AR306657

WESTON

SKETCH MAP

## DRILLING LOG

WELL NUMBER: 28 OWNER: Standard Chlorine

LOCATION: 40' S of N boundary fence about 125' NE of NE corner of warehouse ADDRESS:

TOTAL DEPTH 76.5'

SURFACE ELEVATION: WATER LEVEL:

DRILLING COMPANY: Walton DRILLING METHOD: Auger DATE DRILLED: 11/1/82

DRILLER: HELPER:

LOG BY:

NOTES:

| DEPTH (FEET) | GRAPHIC LOG | SAMPLE NUMBER | SAMPLE TYPE | SAMPLE BLOWS* | DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES) |
|---|---|---|---|---|---|
| 0 | | | | | 0 - 4.0' Brown medium SAND with silt |
| | | | | | 4.0 - 14.0' Brown clayey SILT, slightly plastic, moist |
| | | | | | at 10', trace fine sand |
| | | | | | 14.0 - 19.0' Brown sandy clayey SILT |
| | | | | | 19.0 - 38.5' Brown medium SAND, trace of silt, moist at |
| | | | | | 25', trace of coarse gravel at 30' |
| | | | | | 38.5 - 39.0' Green-brown mottled CLAY, trace silt |
| | | S1 | SS | 5 5 6 | 39.0 - 40.5' 18" recovery, green-brown mottled CLAY, trace |
| | | | | | silt, stiff, dry-went to continuous sampling |
| | | S2 | SS | 3 6 12 | 40.5 - 42.0' 18" recovery green-brown mottled CLAY from |
| 45 | | | | | 40.5' to 41.7', layer of iron concentration |
| | | | | | approx. 0.1' thick at 41.7' followed by tan- |
| | | | | | orange medium SAND, trace silt, wet at 42' |
| | | | | | stopped continuous sampling, saturated at 42' |
| | | S3 | SS | 6 8 8 | 44.0 - 45.5' Yellow-orange fine-medium SAND, trace silt, |
| 50 | | | | | iron stains and fragments evident |
| | | S4 | SS | 9 9 9 | 49.0 - 50.5' Yellow-orange fine-medium SAND, trace silt, |
| | | | | | iron stains and fragments evident |
| | | S5 | SS | 8 10 10 | 54.0 - 55.5' Yellow-orange fine-medium SAND, trace silt, |
| 55 | | | | | iron stains and fragments evident |

* A.S.T.M. D1586

SHEET 1 OF 3



AR306658

WESTON

DRILLING LOG

WELL NUMBER: 28 (cont) OWNER: Standard Chlorine

LOCATION: ADDRESS:

TOTAL DEPTH

SURFACE ELEVATION: WATER LEVEL:

DRILLING COMPANY: DRILLING METHOD: DATE DRILLED:

DRILLER: HELPER:

LOG BY:

SKETCH MAP

NOTES:

| DEPTH (FEET) | GRAPHIC LOG | SAMPLE NUMBER | SAMPLE TYPE | SAMPLE BLOWS* | DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES) |
|---|---|---|---|---|---|
| 60 | | S6 | SS | 9 11 13 | 59.0 - 60.0' Yellow-orange fine-medium SAND, trace silt, iron stains & fragments, SS recovery 12 - 15", no odor in any of samples S3 to S6 |
| 65 | | S7 | SS | 9 10 11 | 64.0 - 65.5' Orange-brown fine -medium SAND, trace of silt and ocassional coarse gravel, no odor |
| | | S8 | SS | 16 10 30 | 69.0 - 70.5' Reddish brown clayey SILT, trace sand, started continuous sampling, observed some iron staining in S8 |
| -20.4 | | | | | NO MERCHANTVILLE |
| 70 | | | | | 71.0 POTOMAC FM |
| | | S9 | SS | 10 14 10 | 70.5 - 72.0' Brown medium-coarse SAND, trace of silt, with iron concentrations (70.5 - 71.0'), red-gray mottled CLAY (71 - 72') |
| | | S10 | SS | 11 10 14 | 72.0 - 73.5' 12" recovery, 72 - 73.5', brown medium-coarse SAND, trace of silt with iron concentrations, red gray mottled clay |
| 75 | | S11 | SS | 8 12 16 | 73.5 - 75.0' 8" recovery, red-grey mottled CLAY, stiff |
| | | S12 | SS | 4 10 12 | 75.0 - 76.5' 15" recovery red-grey mottled CLAY, stiff |
| | | | | | End of boring - 76.5'. 11/2/82 Grouted borehole with 1½ bags concrete, ½ bag bentonite and 40 gal |

* A.S.T.M. D1586

SHEET 2 OF 3



AR306659

WESTON

## DRILLING LOG

WELL NUMBER: 28 (cont)

OWNER: Standard Chlorine

LOCATION:

ADDRESS:

TOTAL DEPTH

SURFACE ELEVATION:

WATER LEVEL:

DRILLING COMPANY:

DRILLING METHOD:

DATE DRILLED:

DRILLER:

HELPER:

LOG BY:

SKETCH MAP

NOTES:

| DEPTH (FEET) | GRAPHIC LOG | SAMPLE NUMBER | SAMPLE TYPE | SAMPLE BLOWS* | DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES) |
|---|---|---|---|---|---|
| | | | | | water. Driller noticed chlorine-like odor |
| | | | | | from hole as augers were pulled out. |

* A.S.T.M. D1586

SHEET 3 OF 3

Well TW-28

# Well Construction Summary

Location or Coords: _____ Elevation: Ground Level _____

Top of Casing _____

## Drilling Summary:

Total Depth 71.0

Borehole Diameter 9 inches

Driller T. Seward

Rig Simco 5000 WS

Bit(s) 8 3/4 inches

Drilling Fluid bentonite mud

Surface Casing NA

## Construction Time Log:

| Task | Start Date | Start Time | Finish Date | Finish Time |
|---|---|---|---|---|
| Drilling: | | | | |
| Geophys.Logging: | | | | |
| Casing: | | | | |
| Filter Placement: | | | | |
| Cementing: | | | | |
| Development: | | | | |
| Other: | | | | |

## Well Design:

Basis: Geologic Log X Geophysical Log ____

Casing String(s): C = Casing S = Screen

| | | | | | |
|---|---|---|---|---|---|
| +2 | -61 | C | | | |
| -61 | -71 | S | | | |

Casing: C1 63 feet of 4 inch diameter, threaded black iron pipe

C2 _____

Screen: S1 10 feet, 0.010 slot, 4 inch diameter iron screen

S2 _____

Centralizers _____

Filter Material Grade 1 gravel

Cement 2:1 cement: bentonite

Other _____

## Well Development:

well development by air, 5 days

development water discharged to tanker truck for treatment in solvent recovery

## Comments:

during development, heavy organic vapors--Std. Chlorine designed and fabricated a vapor-proof system to reduce air emissions

Project _____ Location D - war - ity, DE

Personnel T. Drew

D71

AR306661

WESTON DESIGNERS CONSULTANTS

WESTON

## DRILLING LOG

WELL NUMBER: 30
OWNER:
LOCATION: NXT Liquid Nitrogen Tank (Air Products)
ADDRESS:
TOTAL DEPTH: 73.5
SURFACE ELEVATION:
WATER LEVEL:
DRILLING COMPANY: Walton
DRILLING METHOD: Auger
DATE DRILLED: 11/3/82
DRILLER:
HELPER:
LOG BY: R. Johnson

SKETCH MAP

NOTES:

| DEPTH (FEET) | GRAPHIC LOG | SAMPLE NUMBER | SAMPLE TYPE | SAMPLE BLOWS | DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES) |
|---|---|---|---|---|---|
| 0 | | | | | 0 - 40 No sampling |
| | | | | | 0 - 5 sandy fill (clear) |
| | | | | | 5 - 8 fine medium brown SAND, trace clay slightly plastic |
| | | | | | 8 - 13 medium-coarse SAND, little clay, fine-med. ~~gravel, plastic~~ |
| | | | | | 11 - 12 gravel layer |
| | | | | | 13 - 18 medium-coarse gray/brown SAND |
| | | | | | 18' medium-light brown SAND, trace clay, trace fine gravel |
| | | | | | |
| 40 | | S1 | SS | 5 7 8 | 39 - 40.5 light brown, fine-medium SAND, rust stains |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| 45 | | S2 | SS | 4 8 8 | 44 - 45.5 light brown, medium SAND, trace silt |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | S3 | | 4 5 9 | 49 - 50.5 fine brown SAND, numerous flecs of iron stains |

SHEET 1 OF 3

WESTON

## DRILLING LOG

WELL NUMBER: 30 OWNER:
LOCATION: ADDRESS:
TOTAL DEPTH
SURFACE ELEVATION: WATER LEVEL:
DRILLING COMPANY: DRILLING METHOD: DATE DRILLED:
DRILLER: HELPER:
LOG BY:

SKETCH MAP

NOTES:

| DEPTH (FEET) | DRAWING LOG | SAMPLE NUMBER | SAMPLE TYPE | SAMPLE BLOWS* | DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES) |
|---|---|---|---|---|---|
| 50 | | | | | |
| | | S4 | SS | 6 9 11 | 54 - 55.5 Same as. S3 |
| 55 | | | | | |
| | | S5 | SS | 7 9 11 | 59 - 60.5 iron stained medium-coarse SAND trace fine gravel |
| 60 | | | | | |
| | | S6 | SS | 7 7 8 | 64 - 65.5 Same as S5 |
| 65 | | | | | |
| 70 | | S7 | | 4 7 7 | 69 - 70.5 find sand, some clay - tan/gray green black laminar at base |

70.2 MERCHANTVILLE

R3066663

SHEET 2 OF 3

WESTON

## DRILLING LOG

WELL NUMBER: 30 OWNER:
LOCATION: ADDRESS:
TOTAL DEPTH
SURFACE ELEVATION: WATER LEVEL:
DRILLING COMPANY: DRILLING METHOD: DATE DRILLED:
DRILLER: HELPER:
LOG BY:

SKETCH MAP

NOTES:

| DEPTH (FEET) | GRAPHIC LOG | SAMPLE NUMBER | SAMPLE TYPE | SAMPLE BLOWS* | DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES) |
|---|---|---|---|---|---|
| 70 | | S8 | | | 70.5 - 72 24" recovery, very stiff, red/gray mottled clay 70-5 POTOMAC FM |
| 70.3 | | S9 | | | 72 - 73.5 20" recovery - Same as S8 |

* ASTM D1586

AR306664

SHEET 3 OF 3

Well TW-30

# Well Construction Summary

Location or Coords: _____ Elevation: Ground Level _____

Top of Casing _____

## Drilling Summary:

Total Depth 70.0

Borehole Diameter 9 inches

Driller T. Seward

Rig Simco 5000 WS

Bit(s) 8 3/4 inches

Drilling Fluid bentonite mud

Surface Casing NA

## Construction Time Log:

| Task | Start Date | Start Time | Finish Date | Finish Time |
|---|---|---|---|---|
| Drilling: | | | | |
| Geophys. Logging: | | | | |
| Casing: | | | | |
| Filter Placement: | | | | |
| Cementing: | | | | |
| Development: | | | | |
| Other: | | | | |

## Well Design:

Basis: Geologic Log X Geophysical Log ____

Casing String(s): C = Casing S = Screen

| | | | |
|---|---|---|---|
| +2 | -60 | C | |
| -60 | -70 | S | |

Casing: C1 62 feet of 4 inch diameter, threaded black iron pipe

C2

Screen: S1 10 feet of 0.010 slot 4 inch diameter iron screen

S2

Centralizers

Filter Material Grade 1 gravel

Cement 2:1 cement to bentonite

Other

## Well Development:

well development by air, 3 days

~~development water discharged to tanker truck for treatment in solvent recovery~~

## Comments:

heavy organic vapors during development

Project S dar hlc e. del re

Location D war it DE

Personnel T. Drew

AR306665

WESTON DESIGNERS CONSULTANTS

WESTON

## DRILLING LOG

WELL NUMBER: 31
OWNER: Standard Chlorine
LOCATION: West of Maintenance Shed
ADDRESS:
TOTAL DEPTH: 77.5
SURFACE ELEVATION:
WATER LEVEL: ~50'
DRILLING COMPANY: Walton
DRILLING METHOD: Auger
DATE DRILLED: 11/4/82
DRILLER:
HELPER:
LOG BY:

SKETCH MAP

NOTES:

| DEPTH (FEET) | GRAPHIC LOG | SAMPLE NUMBER | SAMPLE TYPE | SAMPLE BLOWS* | DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES) | |
|---|---|---|---|---|---|---|
| | | | | | 0 - 39' | no samples |
| | | | | | 0 - .5' | fill |
| | | | | | .5 - 12' | red-brown medium SAND, gravel layer at 12' |
| | | | | | | |
| 9 | | S1 | SS | 12 | 12' - 39' | brown, medium-coarse SAND |
| 40 | | | | 7 8 | 39 - 40.5 | brown, medium-coarse SAND with limonite flecs, damp |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| 45 | | A1 | AUGER | | 40 - 45 | brown medium SAND, trace clay, slightly plastic, moist |
| | | A2 | | | 45 - 49 | red brown SAND, little silt, moist |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| 50 | | S2 | SS | 3 4 4 | 49 - 50.5 | fine-medium SAND., iron stained |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | A3 | AUGER | | 51 - 59 | fine-medium SAND, iron stained |

* A.S.T.M. D1586

AR306666

SHEET 1 OF 3

WESTON

## DRILLING LOG

WELL NUMBER: 31 OWNER:
LOCATION: ADDRESS:
TOTAL DEPTH
SURFACE ELEVATION: WATER LEVEL:
DRILLING COMPANY: DRILLING METHOD: DATE DRILLED:
DRILLER: HELPER:
LOG BY:

SKETCH MAP

NOTES:

| DEPTH (FEET) | GRAPHIC LOG | SAMPLE NUMBER | SAMPLE TYPE | SAMPLE BLOWS* | DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES) |
|---|---|---|---|---|---|
| 55 | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | S3 | SS | 5 8 12 | 59 - 60.5 Brown medium SAND |
| 60 | | | | | |
| | | | | | MERCHANTVILLE |
| -12.3 | | | | | 62.5 change in auger resistance - top of clay |
| | | | | | |
| 65 | | S4 | SS | 3 5 8 10 | 64 - 65.5 15" recovery, stiff dark gray CLAY |
| | | S5 | SS | 5 6 | 65.5 - 67 6" recovery stiff dark gray CLAY and silt with mica |
| -18.1 | | S6 | SS | 3 3 5 8 | 67 - 68.5 12" recovery, dark gray CLAY-SILT with 2" mottled gray/rust CLAY on bottom of core |
| | | | | | POTOMAC 68.3 |
| 70 | | S7 | | 11 6 8 14 | 68.5 - 70 mottle rust, gray fine SAND, little silt, non-plastic |
| | | S8 | | 8 10 | 70 - 71.5 same as S7 |
| | | S9 | | 15 5 10 15 | 71.5 - 73 fine SAND, mottled rust, gray, trace clay slightly plastic |
| | | S10 | | 10 | 73 - 74.5 mottled rust, gray medium-fine SAND grades down to SAND and CLAY, Potomac |

* A.S.T.M. D1586

SHEET 2 OF 3

AR308667

WESTON

## DRILLING LOG

WELL NUMBER: 31 OWNER:
LOCATION: ADDRESS:
TOTAL DEPTH
SURFACE ELEVATION: WATER LEVEL:
DRILLING COMPANY: DRILLING METHOD: DATE DRILLED:
DRILLER: HELPER:
LOG BY:

SKETCH MAP

NOTES:

| DEPTH (FEET) | GRAPHIC LOG | SAMPLE NUMBER | SAMPLE TYPE | SAMPLE BLOWS* | DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES) |
|---|---|---|---|---|---|
| 75 | | | | 17 | |
| | | S11 | | 36 | 74.5 - 76 15" recovery - rust, gray mottle, stiff CLAY, plastic |
| | | | | 4 | |
| | | S12 | | 10 | 76 - 77.5 12" recovery - same as S 11 |
| | | | | 26 | |
| | | | | | end of boring |
| | | | | | grouted hole with |
| | | | | | 2 bags cement |
| | | | | | ~ 10 pounds bentonite |
| | | | | | ~ 40 gallons water |

* A.S.T.M. D1586



AR306668

SHEET 3 OF 3

Well TW-31

# Well Construction Summary

Location or Coords: _____ Elevation: Ground Level _____

Top of Casing _____

## Drilling Summary:

Total Depth 62.0

Borehole Diameter 9 inches

Driller T. Seward

Rig Simco 5000 WS

Bit(s) 8 3/4 inches

Drilling Fluid bentonite mud

Surface Casing NA

## Construction Time Log:

| Task | Start Date | Start Time | Finish Date | Finish Time |
|---|---|---|---|---|
| Drilling: | | | | |
| Geophys. Logging: | | | | |
| Casing: | | | | |
| Filter Placement: | | | | |
| Cementing: | | | | |
| Development: | | | | |
| Other: | | | | |

## Well Design:

Basis: Geologic Log X Geophysical Log ____

Casing String(s): C = Casing S = Screen

| | | |
|---|---|---|
| 0.4 - | -52 | C |
| -52 - | -62 | S |

Casing: C1 62 feet of 4 inch diameter, threaded black iron pipe

C2

Screen: S1 10 feet, 0.010 slot, 4 inch diameter, threaded iron screen

S2

Centralizers

Filter Material Grade 1 gravel

Cement 2:1 cement to bentonite

Other

## Well Development:

well development by air, 4 days

development water discharged to tanker truck for treatment in solvent recovery

## Comments:

Project Location Personnel

D war ity, IE

T. Drew

tal rd ord of aw



AR306669

WESTON

WESTON

## DRILLING LOG

WELL NUMBER: TB-49
OWNER: Std. Chlorine
LOCATION:
ADDRESS: Delaware City, DE
TOTAL DEPTH: 73.5'
SURFACE ELEVATION:
WATER LEVEL:
DRILLING COMPANY: Walton
DRILLING METHOD: Auger
DATE DRILLED: 3/31/83
DRILLER: G. Truver
HELPER: T. Wolfe
LOG BY: L. A. Hamilton

SKETCH MAP

NOTES:
SS - split spoon

| DEPTH (FEET) | GRAPHIC LOG | SAMPLE NUMBER | SAMPLE TYPE | SAMPLE BLOWS* | DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES) |
|---|---|---|---|---|---|
| | | | | | 0 - 68.5 Interpreted as Columbia Formation |
| | | | | | 0 - 39 No samples; cuttings are orange, brown fine to medium SAND; some gravel |
| | | | | 18 | |
| | | S1 | SS | 24 | 39 - 40.5 Tan, orange, fine to medium to coarse SAND and gravel; some silt; trace clay |
| | | | | 24 | |
| | | | | | |
| | | | | | |
| | | | | 16 | |
| | | S2 | SS | 18 | 44 - 45.5 Tan, orange fine to medium SAND, trace silt. |
| 45 | | | | 17 | |
| | | | | | |
| | | | | | |
| | | | | 20 | |
| | | S3 | SS | 20 | 49 - 50.5 Tan, orange fine to medium SAND; trace silt; iron ore layer |
| 50 | | | | 18 | |
| | | | | | |
| | | | | | |
| | | | | 11 | |
| | | S4 | SS | 19 30 | 54 - 55.5 Tan, orange fine to medium SAND; some gravel |

* A.S.T.M. D1586



AR306670

WESTON

## DRILLING LOG

WELL NUMBER: TB-49 (Cont'd) OWNER: _____

LOCATION: _____ ADDRESS: _____

TOTAL DEPTH _____

SURFACE ELEVATION: _____ WATER LEVEL: _____

DRILLING COMPANY: _____ DRILLING METHOD: _____ DATE DRILLED: _____

DRILLER: _____ HELPER: _____

LOG BY: _____

SKETCH MAP

NOTES:

| DEPTH (FEET) | GRAPHIC LOG | SAMPLE NUMBER | SAMPLE TYPE | SAMPLE BLOWS* | DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES) |
|---|---|---|---|---|---|
| 55 | | | | | and pebbles |
| | | | | | |
| | | | | | |
| | | | | 27 | |
| | | S5 | SS | 32 37 | 59 - 60.5 Tan, orange fine to medium SAND, trace gravel |
| 60 | | | | | |
| | | | | | |
| | | | | | |
| | | | | 27 | |
| | | S6 | SS | 25 32 | 64 - 65.5 No recovery; auger return is tan, brown fine |
| 65 | | | | | SAND. |
| | | | | | 68.5- 73.5 Interpreted as Potomac Formation |
| | | | | | |
| | | | | 15 | |
| | | S7 | SS | 22 35 | 69 - 70.5 Red and white mottled CLAY; some silt; |
| 70 | | | | | driller felt change at 68.5 |
| | | | | | go to continuous sampling |
| | | S8A | SS | 22 35 | 70.5- 72 Red and white mottled CLAY; |
| | | S8B | SS | 36 | some silt |
| | | | | | |

* A.S.T.M. D1586

SHEET 2 OF 3



AR306671

WESTON

## DRILLING LOG

WELL NUMBER: TB-49 (Cont'd) OWNER:
LOCATION: ADDRESS:
TOTAL DEPTH
SURFACE ELEVATION: WATER LEVEL:
DRILLING COMPANY: DRILLING METHOD: DATE DRILLED:
DRILLER: HELPER:
LOG BY:

SKETCH MAP

NOTES:

| DEPTH (FEET) | GRAPHIC LOG | SAMPLE NUMBER | SAMPLE TYPE | SAMPLE BLOWS* | DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES) |
|---|---|---|---|---|---|
| | | S9 | SS | 11 21 33 | 72 - 73.5 Red and white mottled CLAY; some silt |
| | | | | | Grouted with 2 bags cement; ½ bag bentonite |

* A.S.T.M. D1586

SHEET 3 OF 3

Well TW-49

# Well Construction Summary

Location or Coords: _____ Elevation: Ground Level _____

Top of Casing _____

Project Stoughton Landfill

Location

Personnel L.A. Hamilton

## Drilling Summary:

Total Depth 74 feet

Borehole Diameter 9 inches

Driller T. Seward

Rig Simco 5000 WS

Bit(s) 8 3/4 inch

Drilling Fluid Bentonite mud

Surface Casing N/A

## Construction Time Log:

| Task | Start Date | Start Time | Finish Date | Finish Time |
|---|---|---|---|---|
| Drilling: | 5/3 | 8:45a | 5/3 | 11:30a |
| Geophys. Logging: | | | | |
| Casing: | 5/3 | | 5/3 | |
| Filter Placement: | 5/3 | | 5/3 | |
| Cementing: | 5/3 | | 5/3 | |
| Development: | | | | |
| Other: | | | | |

## Well Design:

Basis: Geologic Log ✓ Geophysical Log ____

Casing String(s): C = Casing S = Screen

| | | | | | |
|---|---|---|---|---|---|
| +3 | 19 | C | | | |
| 19 | 39 | C | | | |
| 39 | 59 | C | | | |
| 59 | 69 | S | | | |

Casing: C1 62 feet of 4 inch diameter threaded iron pipe

C2 _____

Screen: S1 10 feet of .010 slot, 4 inch diameter, threaded

S2 metal screen

Centralizers _____

Filter Material Grade 1 sand 3 bags

Cement 2:1 cement/bentonite mixture

Other 4 bags cement 2 bags bentonite

## Well Development:

Development water discharged to hopper

Development time = 6 days

## Comments:



AR306673

WESTON DESIGNERS CONSULTANTS

Well TW-50

# Well Construction Summary

Location or Coords: _____

Elevation: Ground Level _____

Top of Casing _____

## Drilling Summary:

Total Depth 69 feet

Borehole Diameter ~ 9 inches

Driller T. Seward

Rig Simco 5000WS

Bit(s) _____

Drilling Fluid Bentonite mud

Surface Casing N/A

## Well Design:

Basis: Geologic Log ✓ Geophysical Log _____

Casing String(s): C = Casing S = Screen

| | | | | | |
|---|---|---|---|---|---|
| +3 | 19 | C | | | |
| 19 | 39 | C | | | |
| 39 | 59 | C | | | |
| 59 | 69 | C | | | |

Casing: C1 62' of 4" diameter threaded iron pipe

C2 _____

Screen: S1 10' of 4" diameter, 0.010" slot, steel, threaded screen

S2 _____

Centralizers _____

Filter Material Grade 1 silica sand 2 bags

Cement 2:1 cement/bentonite mixture

Other 4 bags cement 2 bags bentonite

## Construction Time Log:

| Task | Start Date | Start Time | Finish Date | Finish Time |
|---|---|---|---|---|
| Drilling: | | | | |
| | 5/2 | 9:25a | 5/2 | 11:35a |
| Geophys. Logging: | | | | |
| Casing: | 5/2 | | 5/2 | |
| Filter Placement: | 5/2 | | 5/2 | |
| Cementing: | 5/2 | | 5/2 | |
| Development: | | | | |
| Other: | | | | |

## Well Development:

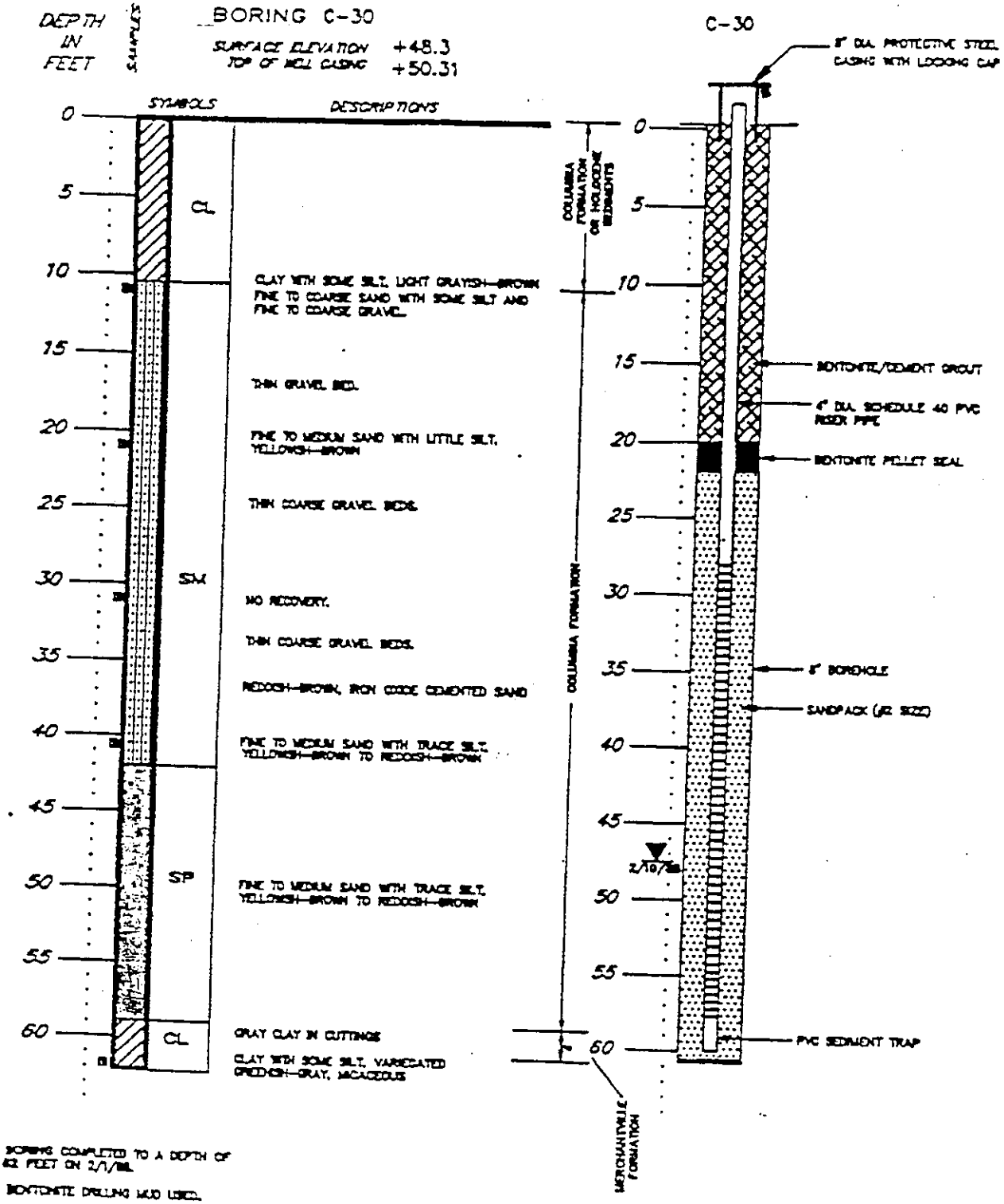
Development water discharged to hopper

Development time=6 days

## Comments:

AR306674

WESTON




NOTES:

1. BORING COMPLETED TO A DEPTH OF 62 FEET ON 2/1/88.
2. BENTONITE DRILLING MUD USED.
3. CAVE IN FROM 61 FEET TO 62 FEET.
4. 4" PVC CASING WITH 0.020-INCH SLOTS FROM 38 FEET TO 58 FEET.

# LOG OF BORING AND MONITORING WELL DETAIL

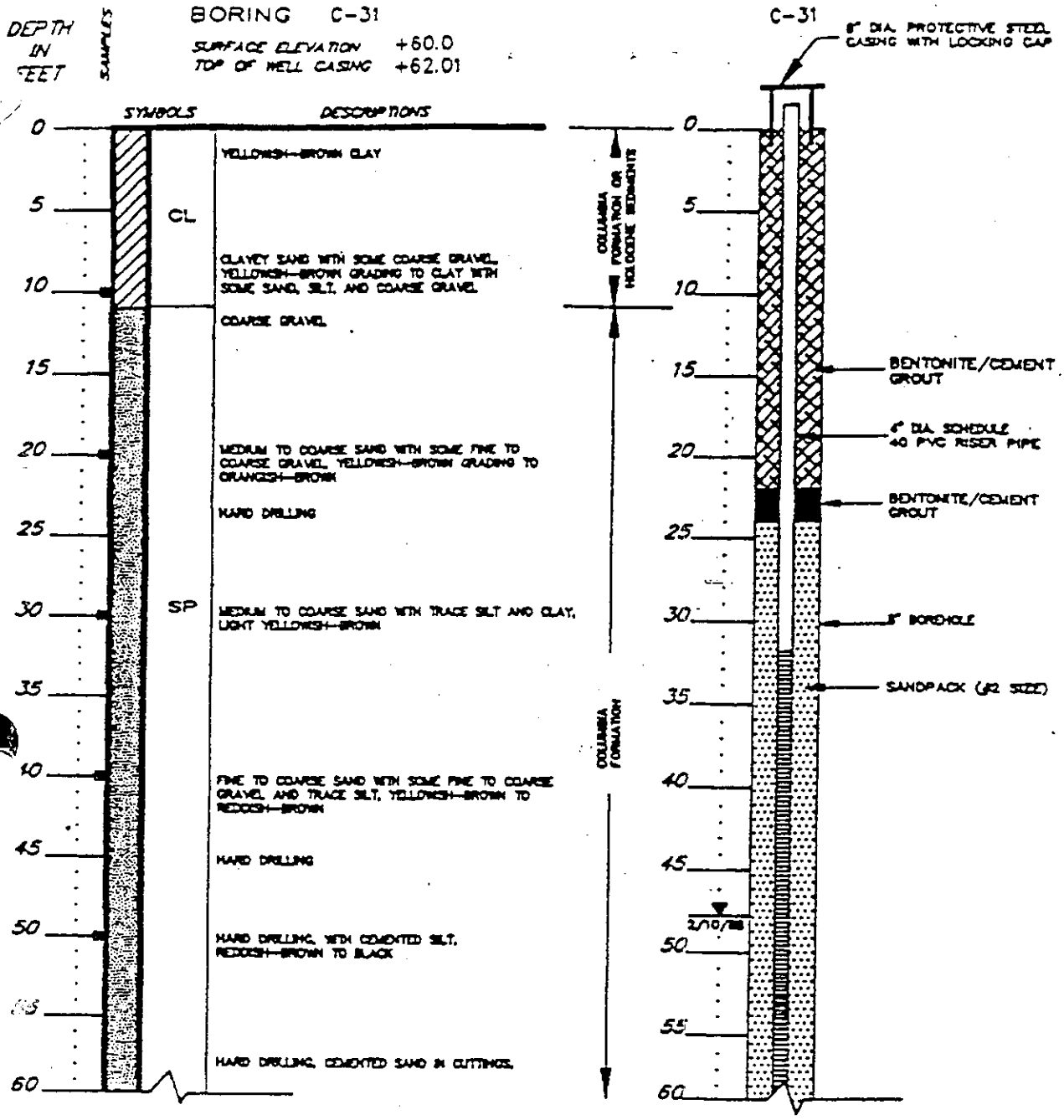
TEXACO REFINERY
DELAWARE CITY, DELAWARE

FIGURE B-2

DAMES & MOORE



AR306675



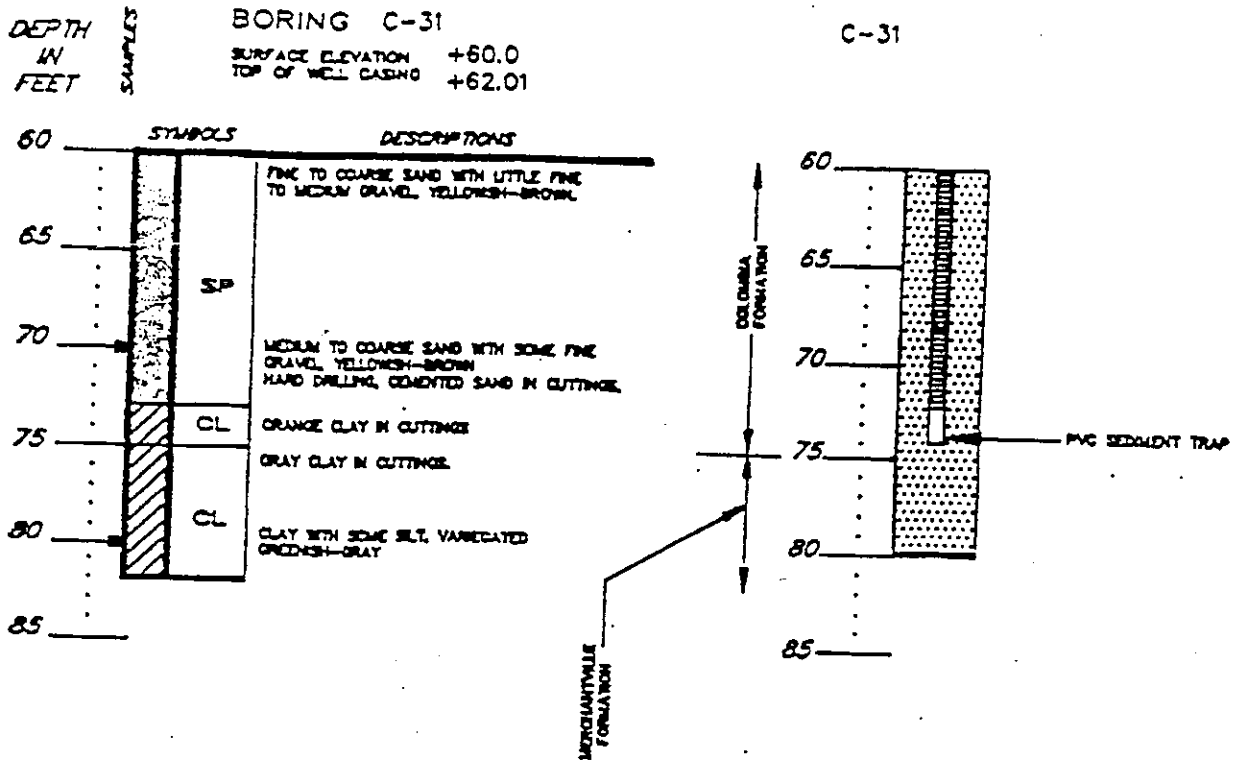

# LOG OF BORING AND MONITORING WELL DETAIL

TEXACO REFINERY
DELAWARE CITY, DELAWARE

FIGURE B-3

DAMES & MOORE

AR306676




NOTES:

1. BORING COMPLETED TO A DEPTH OF 82 FEET ON 2/5/88.
2. BENTONITE DRILLING MUD USED.
3. CAVE IN FROM 30 FEET TO 82 FEET.
4. 4" PVC CASING WITH 0.020 INCH SLOTS FROM 32 FEET TO 72 FEET.

LOG OF BORING AND MONITORING WELL DETAIL
TEXACO REFINERY
DELAWARE CITY, DELAWARE

FIGURE B-3

DAMES & MOORE



AR306677

10. Project Identification and Location of New Withdrawal

a. Well No. or Other Identification RW-1 (State Permit No. 57423)

b. State Delaware

c. County New Castle

d. Municipality Delaware City

11. Attach Map (Preferably USGS Quadrangle) Indicating Location of Project Well and Nearby Existing Wells SEE ATTACHMENT A

12. Physical Description of Location--Refer to Established Landmarks Such as Roads and Streams

South of Red Lion Creek, west of Route 9 and north of Governor Lea Road (See St. Georges Quadrangle Attachment)

13.

| Proposed Use | Proposed Avg. Daily Use | Proposed Avg. Daily Consumptive Use* |
|---|---|---|
| a. Domestic Water Supply | | |
| b. Industrial Process Water | | |
| c. Industrial Cooling Water | | |
| d. Irrigation | | |
| e. Other Contaminated Ground Water Recovery and Treatment | 40 - 75 gpm | 0 |

14. Establish the need for the requested water demand (applicants for irrigation wells shall include the rates of application recommended by the Agriculture Extension Service, total quantities of water required by crops, and the soil types to which water is to be applied).

To create hydrogeologic barrier to control ground-water contaminant migration, and recover and treat contaminated ground water.

*Consumptive use is water pumped from the ground water source that is not returned to the surface or ground waters.

10/28/81



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15. Well Record (Project Well)

Owner Standard Chlorine of Delaware, Inc.

Location Delaware City, Delaware

Owner's Well No. RW-1 Surface Elevation Not Surveyed[1] feet (msl)

Date Well Drilled June, 1984 Well Driller Hydro Group (Layne)

Total Depth Drilled 64 feet Geologic Formation Columbia

Describe measuring reference point Ground surface

Height measuring point is above land surface datum -- *

Diameter: 16 inches

Casing: Diameter 8 inches Length 0 to 50.17 60 to 63.25 feet

Screen: Type 20 slot, wire wound, steel Diameter 8 inches

Top of Screen 50.17 feet Bottom of Screen 60 feet

Static Water Level 42 feet Date 8/14/84

Well Yield 40 - 75 (estimate) pump test not conducted gpm Specific Cap. Test to be conducted gpm/ft

Permanent Pump: Type Turbine

Capacity Maximum - 75 gpm Intake Setting 62 feet

Air Line Depth None feet

Describe Type of Metering Not presently in use - flow meter will be installed for checking flow

*All depths should be measured from measuring point.

16. Driller's Log - Sand and gravel deposits of the Columbia Formation (see attachment B)

Attach separate sheet describing nature and depth interval of subsurface materials, and potential water yielding zones and their static water levels as encountered during drilling of all exploratory test holes or production wells.

[1]This information will be provided upon completion of surveying.

10 Project Identification and Location of New Withdrawal

a. Well No. or Other Identification RW-2 (State Permit No. 57424)

b. State Delaware

c. County New Castle

d. Municipality Delaware City

11. Attach Map (Preferably USGS Quadrangle) Indicating Location of Project Well and Nearby Existing Wells SEE ATTACHMENT A

12. Physical Description of Location—Refer to Established Landmarks Such as Roads and Streams

South of Red Lion Creek, west of Route 9 and north of Governor Lea Road (See St. Georges Quadrangle Attachment)

| Proposed Use | Proposed Avg. Daily Use | Proposed Avg. Daily Consumptive Use* |
|---|---|---|
| a. Domestic Water Supply | | |
| b. Industrial Process Water | | |
| c. Industrial Cooling Water | | |
| d. Irrigation | | |
| e. Other Contaminated Ground Water Recovery and Treatment | 40 - 75 gpm | 0 |

14. Establish the need for the requested water demand (applicants for irrigation wells shall include the rates of application recommended by the Agriculture Extension Service, total quantities of water required by crops, and the soil types to which water is to be applied).

To create hydrogeologic barrier to control ground-water contaminant migration, and recover and treat contaminated ground water.

*Consumptive use is water pumped from the ground water source that is not returned to the surface or ground waters.

15. Well Record (Project Well)

Owner Standard Chlorine of Delaware, Inc.

Location Delaware City, Delaware

Owner's Well No. RW-2 Surface Elevation Not Surveyed[1] feet (msl)

Date Well Drilled June & July 1984 Well Driller Hydro Group (Layne)

Total Depth Drilled 68.58 feet Geologic Formation Columbia

Describe measuring reference point Ground surface

Height measuring point is above land surface datum -- *

Diameter: 16 inches

Casing: Diameter 8 inches Length 0 to 55.5 65.33 to 68.58 feet

Screen: Type 20 slot wire wound, steel Diameter 8 inches

Top of Screen 55.5 feet Bottom of Screen 65.3 feet

Static Water Level 43.17 feet Date 8/10/84

Well Yield 40 - 75 (estimate) pump test not conducted gpm Specific Cap. Test to be conducted gpm/ft

Permanent Pump: Type Turbine

Capacity Maximum - 75 gpm Intake Setting 67 feet

Air Line Depth none feet

Describe Type of Metering Not presently in use - flow meter will be installed for checking flow

*All depths should be measured from measuring point.

16. Driller's Log - Sand and gravel deposits of the Columbia Formation (see attachment B)

Attach separate sheet describing nature and depth interval of subsurface materials, and potential water yielding zones and their static water levels as encountered during drilling of all exploratory test holes or production wells.

[1] This information will be provided upon completion of surveying.

AR306681 3/4/81

10. Project Identification and Location of New Withdrawal

a. Well No. or Other Identification RW-3 (State Permit No. 57425)

b. State Delaware

c. County New Castle

d. Municipality Delaware City

11. Attach Map (Preferably USGS Quadrangle) Indicating Location of Project Well and Nearby Existing Wells SEE ATTACHMENT A

12. Physical Description of Location—Refer to Established Landmarks Such as Roads and Streams

South of Red Lion Creek, west of Route 9 and north of Governor Lea Road (See St. Georges Quadrangle Attachment)

| Proposed Use | Proposed Avg. Daily Use | Proposed Avg. Daily Consumptive Use* |
|---|---|---|
| a. Domestic Water Supply | | |
| b. Industrial Process Water | | |
| c. Industrial Cooling Water | | |
| d. Irrigation | | |
| e. Other Contaminated Ground Water Recovery and Treatment | 40 - 75 gpm | 0 |

14. Establish the need for the requested water demand (applicants for irrigation wells shall include the rates of application recommended by the Agriculture Extension Service, total quantities of water required by crops, and the soil types to which water is to be applied).

To create hydrogeologic barrier to control ground-water contaminant migration, and recover and treat contaminated ground water.

*Consumptive use is water pumped from the ground water source that is not returned to the surface or ground waters.

15. Well Record (Project Well)

Owner Standard Chlorine of Delaware, Inc.

Location Delaware City, Delaware

Owner's Well No. RW-3 Surface Elevation Not Surveyed[1] feet (msl)

Date Well Drilled July 1984 Well Driller Hydro Group (Layne)

Total Depth Drilled 64 feet Geologic Formation Columbia

Describe measuring reference point Ground Surface

Height measuring point is above land surface datum -- *

Diameter: 16 inches

Casing: Diameter 8 inches Length 0 to 50.75 60.58 to 63.83 feet

Screen: Type 20 slot wire wound, steel Diameter 8 inches

Top of Screen 50.75 feet Bottom of Screen 60.58 feet

Static Water Level 35 feet Date 8/7/84

Well Yield 40 - 75 (estimate) Pump test not conducted gpm Specific Cap. Test to be conducted gpm/ft

Permanent Pump: Type Turbine

Capacity Maximum - 75 gpm Intake Setting 62.3 feet

Air Line Depth None feet

Describe Type of Metering None - not presenlty in use

*All depths should be measured from measuring point.

16. Driller's Log - Sand and gravel deposits of the Columbia Formation (see attachment B)

Attach separate sheet describing nature and depth interval of subsurface materials, and potential water yielding zones and their static water levels as encountered during drilling of all exploratory test holes or production wells.

[1] This information will be provided upon completion of surveying.



AR306683 3/4/81

10. Project Identification and Location of New Withdrawal

a. Well No. or Other Identification RW-4 (State Permit No. 57426)

b. State Delaware

c. County New Castle

d. Municipality Delaware City

11. Attach Map (Preferably USGS Quadrangle) Indicating Location of Project Well and Nearby Existing Wells SEE ATTACHMENT A

12. Physical Description of Location--Refer to Established Landmarks Such as Roads and Streams

South of Red Lion Creek, west of Route 9 and north of Governor Lea Road (See St. Georges Quadrangle Attachment)

| Proposed Use | Proposed Avg. Daily Use | Proposed Avg. Daily Consumptive Use* |
|---|---|---|
| a. Domestic Water Supply | | |
| b. Industrial Process Water | | |
| c. Industrial Cooling Water | | |
| d. Irrigation | | |
| e. Other Contaminated Ground Water Recovery and Treatment | 40 - 75 gpm | 0 |

14. Establish the need for the requested water demand (applicants for irrigation wells shall include the rates of application recommended by the Agriculture Extension Service, total quantities of water required by crops, and the soil types to which water is to be applied).

To create hydrogeologic barrier to control ground-water contaminant migration, and recover and treat contaminated ground water.

*Consumptive use is water pumped from the ground water source that is not returned to the surface or ground waters.

15. Well Record (Project Well)

Owner Standard Chlorine of Delaware, Inc.

Location Delaware City, Delaware

Owner's Well No. RW-4 Surface Elevation Not Surveyed[1] feet (msl)

Date Well Drilled July 1984 Well Driller Hydro Group (Layne)

Total Depth Drilled 69 feet Geologic Formation Columbia

Describe measuring reference point Ground Surface

Height measuring point is above land surface datum -- *

Diameter: 16 inches

Casing: Diameter 8 inches Length 0 to 53.33 63.17 to 66.42 feet

Screen: Type 20 slot wire wound, steel Diameter 8 inches

Top of Screen 53.33 feet Bottom of Screen 63.17 feet

Static Water Level 35.33 feet Date 7/26/84

Well Yield 40 - 75 (estimate) Test not conducted gpm Specific Cap. Test to be conducted gpm/ft

Permanent Pump: Type Turbine

Capacity Maximum - 75 gpm Intake Setting 65 feet

Air Line Depth None feet

Describe Type of Metering Not presently in use - flow meter will be installed for metering

*All depths should be measured from measuring point.

16. Driller's Log - Sand and gravel deposits of the Columbia Formation (see attachment B)

Attach separate sheet describing nature and depth interval of subsurface materials, and potential water yielding zones and their static water levels as encountered during drilling of all exploratory test holes or production wells.

[1]This information will be provided upon completion of surveying.

3/4/81

AR306685

WESTON

ATTACHMENT B

RW-1

| | |
|---|---|
| 0 to 60' | Tan sand and gravel deposits of Columbia Formation |
| 60' to 64' | Black clay of Merchantsville Formation |

RW-2

| | |
|---|---|
| 0 - 65' | Tan sand and gravel deposits of Columbia Formation |
| 65' to 68.58' | Red and white clay of Potomac Formation |

RW-3

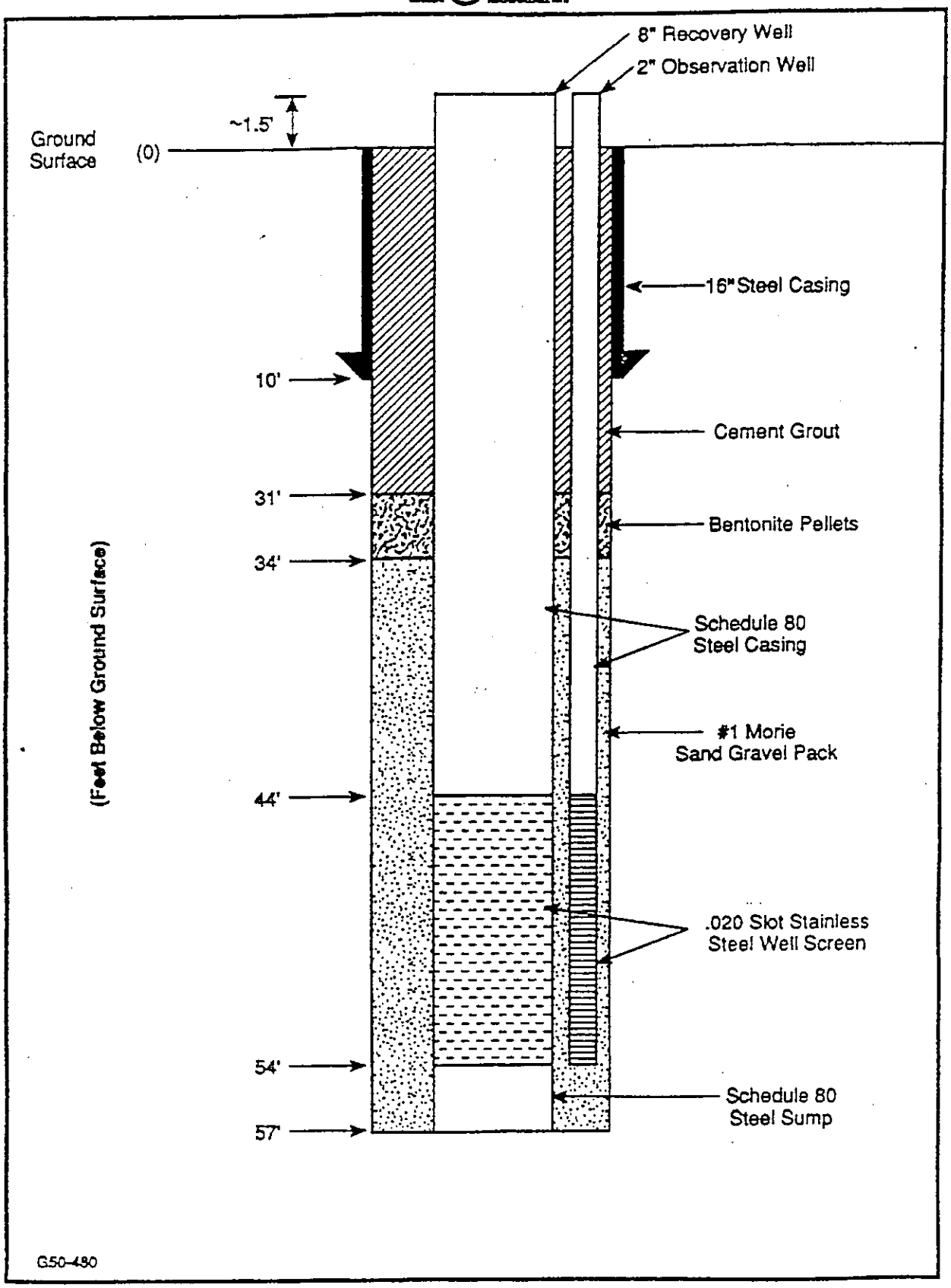
| | |
|---|---|
| 0 to 63' | Tan sand and gravel deposits of Columbia Formation |
| 61' to 64' | Light gray, reddish mottled clay of Potomac Formation |

RW-4

| | |
|---|---|
| 0 to 62'9" | Tan sand and gravel deposits of Columbia Formation |
| 62'9" - 69' | Light gray clay of Potomac Formation |



AR306686




**RECOVERY WELL RW-5**
**WELL CONSTRUCTION SCHEMATIC**



AR306687